RECEIVED
APR 23 1938

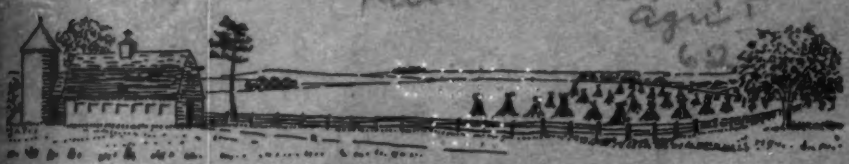
FARMERS DIGEST

MAY, 1938

25c a Copy **$2.00 a Year**

Pasture Improvement to Suit the Farm	*Dr. Howard B. Sprague*	1
Pig Yardstick	*Breeders Gazette*	5
Soil Colloids	*Pacific Rural Press*	7
The New Manchu Apricots	*Country Gentleman*	10
Growing Trellis Tomatoes	*New England Homestead*	12
Fertilizer Placement	*Cappers Farmer*	14
Creep Feeding Calves	*Shorthorn World*	17
Batteries Vs. Range System	*Rural New-Yorker*	21
Land Ownership Won't Make Smart Farmers	*Nation's Business*	25
Do High Testing Cows Produce More Fat?	*Hoard's Dairyman*	31
Horse Doctors	*Horse and Horseman*	34
Internal Quality of Eggs	*American Poultry Journal*	38
Fertility Loss Must Be Figured	*Missouri Ruralist*	40
How Grazing Associations Work	*Western Farm Life*	42
New Models in Pasture Plants	*Southern Planter*	45
New Treatment for Mastitis	*Guernsey Breeders Journal*	52
Alternate Bearing	*American Fruit Grower*	55
Tractor Care	*Kansas Farmer*	59
Know Your Spinach	*Eastern States Cooperator*	65
Danish Dairying	*N. J. Farm and Garden*	69
What Should I Have in My Lease	*Ohio Farmer*	72
Forest Genetics	*American Forests*	75
Barley's Future	*Successful Farming*	80
Outbreeding Best	*Am. Hampshire Herdsman*	84
These Frozen Eggs	*Everybody's Poultry Magazine*	85
$100,000,000 Booms the Piney Woods	*Southern Agriculturalist*	88
Don't Work Cotton for Nothing	*Progressive Farmer*	91
Prize Essay Awards		93

Ref- 754.93 agri 62



The Farmer's Digest

From more than two hundred magazines and bulletins published in this country and abroad, the Editorial Staff of the Farmer's Digest selects articles of outstanding merit and general interest. It is comprehensive in its scope, covering all phases of Agriculture.

The Farmer's Digest

Published monthly at Ambler, Pennsylvania, by
The School of Horticulture

25c a Copy *$2.00 a Year*

Foreign Subscription $3.00 a Year

EDITORIAL STAFF—Editor, L. Bush-Brown
Assistant Editor—C. Leavitt Dyer
Associate Editors: John A. Andrew, Jr., A. E. Heick, R. L. Patrick, Ph. D.

Entered as second-class matter at the Post Office at Ambler, Pa., May 5, 1937, under act of March 3, 1879

The Farmer's Digest

Vol. II May, 1938 No. 1

Choosing Pasture Improvement Systems To Suit the Farm

Howard B. Sprague

Agronomist, New Jersey Agricultural Experiment Station

ALTHOUGH attention has been directed more and more to our grasslands during the last decade, permanent pastures still constitute the greatest undeveloped agricultural resource of the humid regions of this country. Even when largely neglected, pastures produce feed at considerably lower cost than is possible with any type of harvested crop. This is partly because the grazing animal makes no charge for services in harvesting the pasturage, and partly due to the fact that grasslands are the most efficient type of vegetation yet found, from the standpoint of permanent soil fertility.

Great as the present value of pastures may be, there is the possibility of improving the quality of the herbage, the total amount of growth, and the seasonal distribution of feed by suitable management. Few, if any of the cultivated crops offer such great opportunities for increase in production of feed at low cost. It should be emphasized that properly managed pastures produce feed of excellent quality. Feed analyses made on pasture herbage produced under a variety of conditions indicate a protein content of 14 to 20 per cent for dried pasture clippings. Since the content of digestible carbohydrates and of calcium and phosphorous is also high in good pasture herbage, it is obviously important to provide as much of the feed requirements as possible from pastures in place of harvested feeds.

The greatest returns from pastures depend on two important factors; (1) proper soil treatment to stimulate growth of the desired pasture species, and (2) adequate management to insure efficient use of the feed by the grazing herd. Plant growth which is not consumed by livestock is wasted, and it is not possible to

carry a spring surplus of herbage to midsummer, except by harvesting.

The use of lime and commercial fertilizers to increase growth of pastures has given additional feed at lower cost than is possible with hay, silage, or grain feeds. The general acceptance of these facts indicates that livestock farmers have now reached the important point of comparing different systems of pasture improvement to determine which is most profitable. Where the acreage of pasture is limited, i. e., 1 acre or less per animal unit, any system which will furnish feed at lower cost than an equal amount of nutrients in hay and grain feed, is profitable. When the area is not so restricted, it becomes possible to choose the system which yields the cheapest pasturage of good quality.

No hard and fast rules may be drawn as to the most desirable system of pasture treatment, since differences in soil and climate, and the need for feed will vary from farm to farm. However, three general types of management can be listed on the basis of the soil treatment. The first of these systems consists merely in removing all undesirable trees and brush, improving drainage where necessary by open ditches or otherwise, and occasional mowing to control weeds and other unpalatable vegetation. Although the cost of producing feed by this system is very low, it has the serious disadvantage of furnishing herbage of low quality and palatability so that considerable supplemental barn feeding is required. System No. 2 provides in addition to the above treatment, the application of lime, and of phosphate and potash fertilizer. Moderate amounts of such materials usually increase the percentage of clover very substantially, and greatly improve both the yield and quality of herbage. The third system of pasture improvement requires the use of soluble nitrogen fertilizers in addition to lime and mineral fertilizers. In developing a complete pasture program for a given farm, it may be desirable to adopt 2 or all 3 types of treatment on different pasture fields, to provide feed for various classes of stock, and to insure more uniform growth of herbage throughout the grazing season.

A 3 year comparison of the three systems of treatment recently completed on one soil type by the N. J. Experiment Station offers interesting contrasts. On untreated plots, the total annual yield of dried clippings was 1308 lbs. per acre, and the cost was low. On the plots receiving 1 ton of lime, 400 lbs. of superphosphate, and 100 lbs. potash per acre once in 3 years, the yield was 1921 lbs., an increase of 46.9%,

and the quality was greatly improved by the stimulation of clover to the point where this species made up 30 to 40% of the total herbage. The lime and fertilizer cost was 21.3 cents per 100 lbs. of dried clippings. The total cost of producing such material which is equal in feed value to 18% dairy feed, averaged less than $13.00 per ton including charge for land use, labor, etc. It should be noted that the substantial increase in yield was made possible by stimulation of clover which provided the necessary nitrogen through its root nodule bacteria. Since pastures respond strongly to nitrogen, this element must be supplied either by stimulating legumes in the sod, or by the use of nitrogen fertilizers. Unless legumes are stimulated by lime and mineral fertilizers, nitrogen becomes a necessity.

The third treatment included the use of 300 lbs. of sulfate of ammonia yearly in March, as well as lime and mineral fertilizers once in 3 years. With this system the annual acre yield of dried clippings was 2,281 lbs., an increase of 74.4% over the untreated plots. The lime and fertilizer cost was 41.3 cents per 100 lbs. of clippings and the total cost was less than $17.00 per ton. In contrast with the local purchase price of approximately $35 per ton for 18% dairy feed, the production of herbage at this cost is most profitable. With the nitrogen treatment, the abundance of legumes is reduced but the fertilizer compensates for this effect. Where the pasture area is limited, it is economically desirable to produce feed by this means even though the cost is substantially greater than for the system which utilizes lime, minerals and clover.

The above yields and values were calculated on the assumption that the seasonal distribution of herbage would be equally good on all systems. Actually, the production of feed was considerably more uniform for the lime-minerals-clover system. The nitrogen treatment resulted in stimulation of growth 1 to 2 weeks earlier than would otherwise have been possible. However, growth from June 15 to August 15, when pasture is usually scant, was 435 lbs. per acre of dried clippings on the untreated plots, 626 lbs with lime and minerals, and 552 lbs. where nitrogen fertilizer was applied in spring. The total feed produced from August 15 to the end of the grazing season was 273 lbs. per acre on the untreated plots, 414 lbs. on lime and mineral plots, and 375 lbs. on spring nitrogen treated plots. Although the lime and mineral treatment which stimulated clover, provided somewhat less feed than the nitrogen treatments in May and June when there is normally a surplus

of pasture, it produced considerably more feed in the important periods after June 15 when pasture growth is most needed.

Irrespective of the type of treatment used on pastures, the management system must provide certain essentials to insure profitable use of the feed grown. These essentials include grazing early enough in spring to permit the stock to more nearly keep pace with herbage growth, and moderately close grazing throughout the season. Periodic mowing at heights of 2 to 3 inches to prevent the formation of seed heads on grasses and to control weeds greatly improves the value of the pasture. This forces the strength of the forage plants into the production of palatable leaves. Unless the grazing herd can utilize all the early feed, it may be necessary to mow in early June certain pastures for young hay or molasses silage, and return such fields to grazing in July and August. The number of fields in a pasture system should be adequate to permit observation of these essentials in management for efficient utilization of the feed produced.

Calibrate the Seed Drill

W. C. Krueger

MANY seed drills do not sow the indicated rate per acre. This wastes seed or land and invites poor stands. Drills should be calibrated periodically to guide adjustments or so that allowances can be made.

To do this, first multiply the effective width of drill in feet and divide the product into 43,560, which is the number of square feet per acre. The result will be the number of times the wheel must turn to give the equivalent of one acre of coverage. Raise the drill to free one wheel, set rate dial or gauge at required quantity per acre and run seed through drill by giving the wheel the required number of turns.

Checking the quantity actually run through against that indicated will reveal the margin of error if there is any. Correction in setting of the drill to obtain the desired rate of planting can then be made. Calibrating requires less than one hour's time and is well worth doing.—*New Jersey Farm and Garden*

Reprinted by permission from New Jersey Farm and Garden, Sea Isle City, N. J.

567151

"Pig Yardstick"

Condensed from Breeder's Gazette

Prof. E. F. Ferrin

IT is time now to take the hog breeds which have been developed here, and by applying measures of production, select and breed only animals making gains upon the lowest quantities of feeds. The possibilities for improvement are indicated by the experience in Denmark. At the beginning of Denmark's swine improvement program, it took about 400 lbs. of feeds to make 100 lbs. of gain; the latest figures show around 330 lbs. of feeds for a cwt. of gain. If as much could be accomplished in this country, the 200 lbs. of weight represented by the gain of a pig from weaning to market time would be made at a saving of 140 lbs. of feed. What a benefit this would be to American farmers producing about 70 million hogs yearly!

Let us consider some of the facts now available on the problem of getting more pork for less feed from American breeds of hogs. The Department of Agriculture and several state experiment stations have fed out pigs from approximately 1,000 litters in the Record of Performance plan. The general average of feed totals for 100 lbs. of gain is just a little below 400 lbs. Pigs from some litters have made gains on from 330 to 340 lbs. of feeds. This shows that some pigs are much more economical than others in feed utilization, and that it is possible to select stock of high efficiency. The next step is to devise a workable plan for finding out under farm conditions which are the superior hogs.

Fortunately, there are more facts that have been determined by experimental findings. In 80% of all cases, the pig which has made the greatest weight for age has produced the most economical gains. Here then is a simple measure, reasonably accurate, of determining economy of gain by merely weighing pigs at definite ages. Upon this premise are based the brood sow testing programs in operation in Minnesota and Iowa. To put it briefly, the essential points of the Minnesota plan are described:

1. Each litter must be ear notched within 7 days of the date of birth and a record made of the breeding and the number of live pigs of each sex.

2. All litters shall be weighed when from 50 to 62 days of age

Reprinted by permission from the Breeder's Gazette, Spencer, Indiana, March, 1938

and the weights calculated to a 56-day basis. Weights at 180 days of age are also recorded when possible.

3. When selecting gilts for the breeding herd, those from the litters of heaviest weights are chosen.

Litter weights of pigs at weaning time are very useful in culling the sow herd when some sows are to be fattened for market and some kept for later litters. The selection of gilts from rapidly growing, heavy-weight litters utilizes the best breeding stock available in the herd and insures against the reproduction of slowly growing, expensive pork machines. Early marketing of March farrowed pigs is necessary for the highest net returns, and the selection of the right kind of breeding stock is about half the recipe.

Boars as well as gilts need to be selected from heavy-weight litters in order to make the program complete. Several breeders of purebred hogs in the western Cornbelt have found that boar sales are much easier to make when definite figures of litter weights are kept. The most convincing sales argument to the market hog man is the actual weight record of the litter in which the boar was produced. With so much emphasis now on early maturing market hogs, the breeder with the evidence of the scales to submit makes his sales quickly.

The brood sow selection plan has been gaining steadily in favor in Minnesota during the last 3 years. At first, a few scattered co-operators were enrolled by county agents who were too busy with other duties to have much time to spend upon the plan. In 1937, members of a cost accounting service in Fillmore County engaged in the program and completed 117 records. The range in weights of the litters at weaning time was surprising, showing that only a part of the sows in each herd were really profitable producers. On one farm where 24 litters were raised, only 5 of these litters reached weights above 200 pounds at weaning time. Instead of gilts selected at random for the mothers of the 1938 crop of pigs, this herd is now composed of brood sows out of the top litters. The heaviest litter produced in this county weighed 336 lbs. and consisted of 10 pigs. The largest litters do not always make the heaviest weights, because frequently there are some small unthrifty pigs.

To be a profitable litter, there should be from 7 to 10 uniform pigs at weaning, weighing from 30 to 35 lbs. per pig. Gilts cannot be expected to match the performance of older sows, the difference amounting to 9/10 of a pig between first litters and later litters. It is reasonable then to expect the tried sow to average 1

pig more raised per litter than the gilt. A high standard for production by a gilt is a litter of 7 pigs weighing 245 pounds at 56 days of age and for an older sow a litter of 8 pigs weighing 280 pounds.

Litter weights in the University of Minnesota herds have been kept for several years. In the spring of 1935, the average weaning weight per litter was 221 lbs.; in 1936, 227 lbs. and in 1937, 239 lbs. The weights are all on a 56-day age basis and include about equal numbers of gilts and older sows. The best record for a gilt in 1937 was a litter weighing 379 lbs. Lest there be some doubt about the weaning weights being truly representative of weights at 180 days of age, it should be said that, barring disease and accident, there is a very close check.

More meat from less feed soon will be a goal for the majority of swine producers. Marketing problems always will be arising to plague the grower of pork, but you can't keep down the man who makes his hogs gain a hundred pounds on less feed than those of his neighbors.

Soil Colloids, Key to Successful Fertilization

Condensed from Pacific Rural Press

Hans Jenny

University of California

IN 1850, an Englishman by the name of Thomas Way performed an experiment which set the scientific world on fire. So unexpected were the results that the great agricultural chemist, Justus von Liebig thought it was all a joke, and did not even bother to repeat the test. Today, Way's experiment is demonstrated every year to thousands of agricultural students all over the world. What is the experiment all about, and why it is so important?

Suppose you take a glass tube or a wide iron pipe, fill it with dirt, and pour some brown liquid stable manure on top of it. You will observe that the liquid leaves the tube colorless and crystal clear. The organic substances are retained by the soil. Quite simple, you will say, the soil acts merely as a fine sieve. Without pressing this point, let us go a step further and pass some mineral fertilizer, say, ammonium sulphate through the soil filter. Now, we know for certain that no sieve is fine

Reprinted by permission from Pacific Rural Press, 560 Howard St., San Francisco, Cal., Feb. 19, 1938

enough to hold back ammonium sulphate which consists of but very few, tiny atoms. Nevertheless, the soil also retains this fertilizer particle, but only half of it, namely, the ammonia part. The sulfate part follows the water stream and percolates through the soil. This is exactly the point which Way discovered some eighty years ago. Since the plant needs ammonia rather than sulfate, Way was impressed by this planned economy of Mother Nature.

The lesson we draw from this early experiment has an important bearing on fertilizer practices. Many a farmer buys fertilizer because it promises an immediate increase in crop yields. He overlooks the fact that fertilizer not only affects the plant but combines chemically with the soil, and in doing so, may either improve or harm it. Moreover, the interaction may defy the very purpose of fertilization.

Ever since Way's discovery, soil chemists all over the world have made serious attempts to learn more about this fixing power of soils for fertilizers. They constructed complicated apparatus and machinery to isolate various soil fractions, subjected them to detailed chemical analysis, and studied reactions with a great variety of fertilizers. A few decades ago, it was found that a particular class of soil particles, the so-called colloids, were mainly responsible for the process. Colloids occur in every soil though their amounts vary from traces to over eighty per cent. These colloidal particles are larger than fertilizer molecules but still so small that they cannot be seen, even with the best microscope.

In spite of their invisibility, a great deal is known about them. The University of California, particularly the laboratory of Professor Kelley, has been a leader in this important field of research. The reason for the concentrated efforts on soil colloid studies lies in the observation that colloids not only react with fertilizers, but in addition they do a lot of other things. They attract water and thus play an important part in the water household of the soil. In the rainy season, they swell and expand many times their own volume; they exert enormous pressures on their surroundings and thus cause cracking of highway pavements and concrete walls. In summer time, they lose their water by giving it to plants. Shrinkage takes place, cracks develop in the field and building foundations may become seriously affected. The soil colloids are also responsible for the muddy appearance of many rivers and lakes and in this connection present grave problems to the engineering profession. Evidently, not

only the farmers, but also the engineers are vitally interested in the properties and behavior of soil colloids!

Not long ago, Dr. Dore, of the California Agricultural Experiment Station, had the lucky idea of passing X-rays through soil colloids, and to the surprise of all soil chemists, he obtained excellent photographs which reveal the interior structure of the colloidal particles. This at once opened a new field of approach which may help to clarify some of the perplexing problems of California soils. We know already that in California soils, there are at least three types of colloids, the montmorillonite, the kaolinite, and the X-mineral. Their relationship to soil fertility problems is now being invesigated.

How differently soil colloids react towards fertilizers is illustrated by the Aiken type soils and the Vina soils. The Aiken soil colloids strongly fix phosphates whereas the Vina soil colloids fix potassium. In these instances, the normal application of fertilizer quantities is not sufficient, because of the high fixing power of the colloids. A word of caution regarding the word "fixing" may be in place. All soil colloids fix fertilizer elements though to various degrees. The weak fixation, which is sometimes known as adsorption, is beneficial. Rain water or irrigation water cannot leach out the weakly held nutrients but plants can easily utilize them. The strong fixation represents a serious soil problem which is not well understood. Here, the nutrient ions mysteriously disappear into the soil colloids and neither plants nor human efforts can make them available again. In certain prune orchards, particularly those which show dieback, potassium is fixed in this manner. In some soils of the foothill areas, phosphates combine with colloids so strongly, that annual plants starve, unless given very liberal amounts of phosphate nutrients.

Some soils are acid, and if extremely so, require very specialized fertilizer treatments. Again, it was found that the troublesome soil acidity is caused by particular types of soil colloids. Fortunately most California soils are not acid or only to a moderate degree. In the eastern United States, where rainfall is high and consequently soil leaching profound, soil acidity is prevalent, and the use of lime, as a correcting agent, is widespread.

It is not an exaggeration to state that the colloids are the most reactive inorganic substances in California soils. To unravel their secrets is a difficult but fascinating undertaking and holds much promise for a successful solution of many soil fertility problems.

The New Manchu Apricots

Condensed from Country Gentleman

N. E. Hansen

THE new Manchu family of apricots, which we have been working with here at South Dakota State College, Brookings, for several years, is ready for distribution and planting this spring. These new apricots come from a parentage that should enable them to endure temperatures down to 50 degrees below zero, which will make them suited to the prairie northwest of this country and for hundreds of miles north of the Canadian line. Just how far south they will be suited, I do not know yet, but here at Brookings the Manchu family of trees have withstood extreme heat and drought. Missouri, Iowa, Kansas and Nebraska, and states farther east, should be well suited to growing them. I am sure they will go south clear into the Cotton Belt.

The hardy Manchu trees were widely distributed from Coast to Coast in 1936 and 1937, and leading Western nurserymen are propagating them as rapidly as possible. Several South Dakota nurserymen have trees ready this spring. Iowa and Missouri nurseries are working hard to propagate a big stock for next year's trade. The Southern nurseries likely will use peach stock, which will make very rapid work of it. Heretofore California has raised approximately 95 per cent of the country's apricots, but with this new family, fruit growers in both cold and hot and dry areas can plant with confidence.

These new apricots were developed through the hybridization of good California varieties with stocks I brought home from several trips, covering a period of many years, through Siberia and what is now Manchukuo. My son and I have traveled many thousands of miles through Eastern Asia, hunting hardy stocks. Some of these were growing in bitter country where the temperature reached 67 degrees below zero. From this tough parentage, combined with the quality of our own sorts, we have this new family that ought to endure any climate we submit it to. The twelve named varieties of the Manchu group are:

Manchu—Large yellow fruit; heavy crop. Fresh fruit No. 1 in size and quality. Cooks up into

Reprinted by special permission from Country Gentleman, Copyright, 1938, by The Curtis Publishing Company, Philadelphia, Pa.

good quality yellow sauce. Apparently the largest fruit in this group.

Mandarin—Fruit large, rich yellow color; one of the best in quality, fresh or when cooked.

Chow—Tree productive; fruit large, good eating. Produces pale yellow sauce of good quality.

Sing—Tree productive; fruit large. Produces rich orange yellow sauce; flavor stronger than some of the others.

Ninguta—Fruit large yellow, with red blush. Crop very heavy. Season late. One of the mildest and best in the group.

Tola—Large, freestone. Makes highest quality sauce. Season early.

Anda—Tree productive; fruit large and of good quality. Stays firm and holds its shape in cooking. One of the best.

Zun—Nearly excellent in quality. Pit small, round, freestone.

Sino—Heavy producer; fruit small and of excellent flavor.

Lalin—Fruit large, with red blush. Season early. Fresh fruit of good quality. No cooking tests as yet.

Hulan—Very heavy crop of large fruit. Season early. Cooks into a nice-flavored sauce.

Sansin—Heavy crop of large fruit. Fresh fruit of excellent quality; makes a rich orange sauce.

I named and sent out twelve varieties, because they all differ in important characteristics—size, color, eating and cooking qualities, season of ripening, size and shape of trees and so forth.

As to color—is the public's preference for light yellow, deep yellow or deep orange? Do people prefer the largest size or the very best in quality with somewhat smaller size? From the twelve varieties in this hardy group they can take their choices. A great advantage of these apricots is that they come on ahead of the plums, and besides providing fresh fruit and sauce for the grower they should find a ready market. The important thing is that they are adapted to areas of the country where there has been no—or very little—apricot growing.

Growing Trellis Tomatoes

Condensed from New England Homestead

Robert E. Young

DURING the past five years there has been a change in the method of growing tomatoes in Massachusetts, particularly in the eastern half of the state. This change has been from flat culture to production on trellis or stakes. In several ways the trellis method is superior to the old method of production, the advantages being earlier yields, better quality of fruit, larger yields per acre, continued good yields until frost, easier picking, spraying, and dusting.

In experiments conducted to determine the value of trellising tomatoes and the best method of procedure, it was found that a trellised tomato plant will produce twice as much early fruit as one grown flat. The fruit yield on an acre basis would be over four times as great, as the trellis tomato plants are planted much closer in the row.

In changing from flat culture to trellis production of tomatoes, it has been necessary to change the variety. When the stalks of the plant are kept pruned of side branches, it reduces the number of fruit clusters on the plant. To make up for this reduction, a good trellis variety must have a larger number of fruits per cluster with the clusters spaced close together on the stem. Where a fairly small tomato is desired, the Comet is the most popular variety. Where larger fruits are necessary to suit the market, such varieties as Bonny Best, Marglobe, and Scarlet Dawn are grown.

In the production of trellis tomatoes the plants are handled no differently than for flat culture. The seed should be started some time in March. The time of sowing will depend on the temperature which can be maintained in the hotbed or plant house. The lower this temperature, the earlier the seed must be sown. The plants should be brought along in such a way as to keep them growing continuously. Purple color on the stem and leaf veins usually indicates too low a temperature. The plants should be potted at the time of the last transplanting if possible, as potted plants produce an early yield of one-third to one-half more than bedgrown plants.

If pots are not available, berry baskets, divided flats, or proper-

Reprinted by permission from the New England Homestead, Springfield, Mass., March 12, 1938

ly made paper pots may be substituted. Recent experiments have indicated that most growers have been hardening their plants too much before setting them out. A little hardening is considered desirable to withstand the handling during setting but a very hard plant is slow to start growth in the field.

The cost per acre for growing trellis tomatoes is high but not so high as to make it prohibitive. An acre of tomatoes requires 100 large posts, 900 small posts, 10,000 feet of No. 12 wire, 20,000 feet of No. 20 wire, and 50,000 feet of jute twine. Some small posts or angle irons are also necessary for guying the end posts.

The rows should be spaced four feet apart. Place a large post at the end of the row and a small post every 15 or 20 feet. Many growers have obtained used pipe for the center posts. The large wire is run along the tops of the small posts and drawn tight around the end posts. A line of small wire is stretched four inches above the ground line on which to tie the string. A second small wire is stretched about three feet from the ground and the string which supports the plant is given a turn around it when the plants are tied up. This center wire is to prevent the wind from damaging the plants. The trellis may be constructed either before or after the plants are set.

Since the cost of growing an acre of trellis tomatoes is high, it is necessary to select a good type of soil. The soil should be fairly well drained loam that warms up early in the spring. It is important that the soil hold moisture during dry weather. A grower is probably justified in selecting his best land for tomatoes.

Experimental results and growers' experiences have shown that trellis tomatoes respond to a fair application of manure. It is questionable if tomatoes should be trellised if some manure is not available unless they are to be planted on a good rich loam. Since the yield of trellis tomatoes will run as high as 40 tons per acre, it is necessary that plenty of fertilizer be used. At least, one ton per acre of a 5-8-7, a 5-10-5, or a similar analysis, should be used. An additional application of 500 to 1,000 pounds of superphosphate per acre has produced earlier and better fruits on some types of soil. Broadcasting the fertilizer has given better results in most cases than row applications. About the time the first fruits are picked, an application of quickly available nitrogen such as nitrate of soda or sulphate of ammonia should be applied at the rate of 300 pounds per acre. Two succeeding applications of similar amount applied at intervals of three weeks will help greatly to increase the size of

fruit particularly on sandy soil.

In growing trellis tomatoes, either one or two stalks are allowed to grow and all side branches are removed from the stem. It is necessary to go over the tomatoes once or twice a week to remove the suckers or side shoots and train the main stem around the twine.

There is not a great amount of difference in the cracking of fruit grown on trellis or flat culture. In most cases, cracking is brought about by a lack of adequate water supply at all times during the growing season. To justify the large expenditure necessary to grow trellis tomatoes an adequate irrigation system is needed to insure a good crop. Heavy rains following a long, hot, dry period will crack most of the fruit on the plant unless the soil has been kept moist by irrigation.

Fertilizer Placement

Condensed from Capper's Farmer

C. Moran

PLACING fertilizer in a band at the side of the row about 2 inches from the seed and a little below the level of the seed or seed piece, avoids early injurious effects and assures the greatest benefit to the crop.

Hundreds of tests by Federal, state and commercial agencies support that conclusion. They also prove that a part of the $300,000,000 which farmers spend annually for fertilizer is wasted because the fertilizer commonly is not put where it will do the most good.

The experiments were made with cotton, corn, potatoes, tobacco, sugar beets and various truck crops such as beans, cabbage, carrots, celery, kale, onions, spinach and peas. They showed that fertilizer applied at the time of planting more than about 3 inches to the side of the seed or transplanted seedling does not immediately stimulate growth.

At the other extreme, it was learned that fertilizer applied in appreciable amounts close to the seed or seedling roots or in such a position that the seedling comes in contact with a high concentration of the soluble fertilizer salts, usually delays germination, retards seedling growth, or causes high mortality of plants.

"These findings are especially important to farmers," says G. A. Cummings, of the Bureau of

Reprinted by permission from Capper's Farmer, Topeka, Kansas, Dec., 1937

Agricultural Engineering, "in view of the increase in recent years in the use of more readily soluble and more highly concentrated fertilizer materials. And the recent introduction of granulated and pellet fertilizers of free-flowing properties has imposed new requirements in the machine placement of fertilizers."

Sixty-seven cooperative fertilizer placement experiments were made in 16 States last year by the United States Department of Agriculture, State Experiment Stations, and various commercial fertilizer organizations. All confirmed previous results proving the efficiency of side placement of fertilizer.

In 28 experiments on cotton in North Carolina, South Carolina, Georgia and Mississippi during the last six years, the investigators increased the yield of seed cotton by 30 per cent thru use of the side placement method, as compared with yields where the fertilizer was placed in a band under the seed, and by more than 20 per cent as compared with rows where fertilizer was mixed with the soil under the seed.

In all these experiments, 800 pounds of 4-8-4 fertilizer an acre was used, since this is the quantity commonly applied to cotton fields east of the Mississippi river. In soils west of the river, from 300 to 500 pounds have been found generally to give as good results as larger quantities.

Good results were obtained in the tests by mixing the fertilizer with the soil to a depth of 3 inches under the seed, but better results by putting it in a band 1½ inches to each side and 2 inches below the level of the seed.

The average yield from side placement was 1,103 pounds of seed cotton an acre, compared with 850 pounds where the fertilizer was put in a band under the seed, and with 999 pounds where the fertilizer was mixed with the soil.

The question then arose as to whether applications to only one side of the row are as effective as applications to each side. In 61 experiments in eight Cotton Belt states, almost equal yields were obtained from both methods.

In experiments with potatoes, a band of fertilizer placed 2 inches to each side and slightly below the level of the seed piece yielded an average of 305 bushels an acre, in Maine, New Jersey, and Virginia.

Thirteen experiments were made in the potato tests, using 2,000 pounds of 4-8-7 to the acre in Maine and New Jersey, and 2,000 pounds of 6-6-5 in Virginia.

The average yield where the fertilizer was mixed with the soil around the seed piece in a strip 5 inches wide was 276 bushels an acre; where it was placed in a 4-inch band approximately 1 inch

under the seed piece, the average yield was 267 bushels.

Placement tests on tobacco were made in Maryland, North Carolina, South Carolina and Georgia. In these, an average yield of 1,415 pounds of tobacco an acre was obtained where the fertilizer was placed in a band 2½ inches to each side and 1 inch below the root crown.

This yield compared with an average of 1,267 pounds where a 2¾ inch band of fertilizer was placed 1 inch under the plants, and with 1,259 pounds where the fertilizer was mixed with soil around the plant roots in 5-inch strips. In the tobacco tests 1,000 pounds of 3-8-6 or 500 pounds of 6-16-12 were used.

Cummings says that in these tobacco tests the average indicated value of tobacco in dollars an acre, covering both yield and quality, was $266 in the case of placements of fertilizer to each side of the row, compared with $195 where the fertilizer was put under the plants, and with $209 where the fertilizer was mixed with the soil around the plants.

Similar increases in yields have been obtained by side placements in tests on snap beans in Florida and on peas in New York.

In the Florida tests, 700 pounds of 5-7-5 were used at time of planting and 700 pounds side dressed. The average yield of snap beans in 8 experiments was 3,214 pounds an acre where fertilizer was placed in a band 2 inches to each side of the row and 1½ inches below the seed level.

The yield averaged 2,080 pounds of beans from 1¾ inch band 1 inch under the seed, and 2,561 pounds where the fertilizer was mixed with the soil under the seed to a depth of 3 inches in a 4-inch strip.

In the New York experiments, fertilizer of 4-16-4 analysis was applied at the rate of 300 pounds an acre to cannery peas. The yield of peas an acre was 2,877 pounds where the fertilizer was placed in a band centered 2½ inches from the 1 inch below the seed level.

Experiments with a number of other crops have demonstrated the superior value of side placement. For crops such as corn and tomatoes grown in widely spaced hills, a further advantage was secured by confirming the fertilizer to short bands at the hill.

In experiments with all the crops the side placement method was more productive irrespective of whether the fertilizer was applied at the time of planting or several days in advance of planting. It was especially advantageous, too, under conditions of low rainfall during the period of seed germination.

A new depositor for corn planters places the fertilizer in a band at each side of the row a

little above the seed level, either in continuous strips or in short bands at the hills. Side placement depositors have become standard equipment for several makes of potato planters. Equipment for the side placement of fertilizer on cotton has been developed. One machine is a 2-horse combined planter and distributor which puts the fertilizer in a band at each side of the row by means of disk furrow openers. Another is an attachment for tractor planting equipment which does a similar job.

Fertilizer distributing equipment for green beans and other crops is being developed. Attachments for wheel-type cultivators, now available, can be used to put the fertilizer in parallel bands before or after planting so as to obtain a side placement.

Creep Feeding Calves

Condensed from The Shorthorn World

Roscoe R. Snapp

Urbana, Illinois

BEEF calves born before April 1 may be marketed to advantage at nine months of age if they are fed enough grain to make them fat. In fact, some men who have most of their calves come in February and early March are able to get sufficient finish on them to sell them at top prices in November and early December. However, such a quick turnover calls for careful feeding and management. In the first place, it requires a herd of good type. Both the sire and dams must possess plenty of size to insure rapid gains. At the same time, they must be low set and thick fleshed to give their calves that early maturity which insures the simultaneous production of muscle, bone and fat, rather than the production of only muscle and bone. Big, thin calves sell very poorly in the fall. They are too thin for the butcher and too heavy and coarse for the feeder. Little, fat calves may be pretty to look at, but they are likely to be too small and "vealy" to command good prices for slaughter. Moreover, they draw too small a weight ticket to bring enough money to be profitable to their owner. On the other hand, fat calves, which at nine to ten months of age weigh around 700 pounds, will be sufficiently be-

Reprinted by permission from the Shorthorn World, 37 Island Ave., Aurora, Ill., March 10, 1938

yond the veal stage to make first class baby-beeves, and will have enough weight to bring a substantial amount when sold.

However, 700-pound calves at nine months of age are unusual, possibly so unusual that even experienced cattlemen are inclined to doubt that calves can be made to weigh that much at so young an age. Nevertheless, it can be done if one has the right kind of calves to start with and if he gives them the right kind of feed and management to keep them growing at their limit.

Let me quote a few figures showing what some good farmers have done who have small herds of beef-type cows.

No. of calves	Breed	Ave. birth date	Date sold	Ave. age days	Market weight, lbs.	Dressing percentage
10	Hereford	Feb. 15	Nov. 2	260	709	59.7
16	Angus	Feb. 1	Dec. 15	317	690	60.0
10	Shorthorn	March 18	Dec. 15	277	624	61.5
10	Angus	Feb. 15	Dec. 16	304	796	60.3

Here are four lots of calves, averaging slightly over 700 pounds in weight, taken almost at random from some records I have at hand. While these examples are random samples from the records, the records themselves are by no means random samples of the farms of the country. Instead, they are records taken on farms where the very best systems of feeding and management prevail, and where the type of cattle kept is far superior to the average of the country as a whole. In few cases, if any, are they records of first attempts to handle a breeding herd. Rather they are reports of men who have been in the cattle business a long time and who have years of experience to guide them in solving their feeding and management problems. I say feeding problems, for in every case the calves were fed as much grain as they would eat while they were still running with their mothers. In fact, grain feeding was begun when the calves were about six weeks of age and continued without interruption until the calves were marketed.

Several years of experience with creep-fed calves at the Illinois Experiment Station have convinced us that it is very important to teach calves to eat grain before they are turned on to pasture, otherwise they will shy wide of creeps and feeding equipment erected in pastures for their use. If, however, they are taught to eat before they leave the dry lot, they will enter creeps readily and eat the grain which is offered them.

One of the advantages of early

calves is that they are old enough to be eating nicely before they are turned on to grass. Calves born in April, on the other hand, have not learned to eat when the grazing season begins and frequently cannot be induced to go near the troughs in which feed is offered. Even though but two or three calves are old enough to eat while the herd is still in the dry lot, it will pay to feed them, for these older calves will set an example for the younger ones and soon the younger calves will be eating. This was illustrated forcefully a few years ago with some experimental calves born in April and May, with the exception of one calf which was born in February. This calf, of course, learned to eat before going to pasture, whereas the younger calves did not. The average daily consumption of grain in the lot having the older calf was almost twice that of the other lot, in which all the calves were youngsters.

Even older calves will eat much more readily if the creep and troughs are erected near the water tank or at some shady spot where the herd congregates two or three times each day. Several openings into the creep for the calves to go in and out are much better than one which may be blocked by a cow which is standing or lying directly in front of it.

A covered trough of the self feeder type is recommended to hold the feed as such equipment protects the feed from rain and storm damage, and requires less labor and attention in refilling. Sufficient trough space should be provided to allow almost all of the calves to eat at the same time, as frequently the herd will stop in the vicinity for only a few minutes before moving on to some other part of the pasture.

Feed mixtures for nursing calves are usually made up largely of farm grown grains. A mixture of equal parts of shelled corn and oats by measure has given excellent results and is widely used for creep feeding. Usually the grain is fed whole, but if the calves are slow to begin eating, the use of ground feed for a week or two is recommended. After they are accustomed to eating, most calves show a preference for whole grain; moreover, whole grain is damaged to a much less extent by unfavorable weather than is ground feed.

Apparently little is to be gained by adding linseed meal or other protein feeds to the ration of nursing calves. The protein which they receive in their mother's milk and in the fresh green grass which they eat is sufficient for their needs, at least until midsummer or early fall. At that time many of the cows will be nearly dry; also the pastures are frequently brown and bare.

Hence, about August 1 to 15, the addition of one-half pound of linseed, soybean, or cottonseed meal per head daily will be of much value in preventing the gains from falling off at this season of the year.

How much grain will a calf eat while it is running with its mother on pasture? Also how much extra weight will it put on above that which it would make on only its mother's milk and grass? These are timely questions on which we have considerable data to prepare answers. Calves under three months of age eat very little grain; as a rule, not much more than a pound per head daily, and frequently not even that, if their mothers are good milkers and they are able to satisfy their appetites from that source whenever they feel hungry. Between three to six months of age, however, their consumption of grain shows a marked increase, frequently amounting to as much as 3 or 4 pounds per day as an average for this period. After six months, calves get little or no milk from their mothers; also they have by this time attained sufficient size and age to consume considerable quantities of feed. Seven or 8 pounds of grain, 1 pound of protein supplement, and 2 or 3 pounds of hay represent the average daily feed required when the calves are six to ten months of age. Therefore, from 10 to 15 bushels of corn, 5 bushels of oats, and 100 pounds of protein supplement are consumed per calf up to the time it is approximately ten months of age.

Is the use of this feed justified? Farmers who have followed this plan evidently are satisfied with it, as they continue to follow it year after year. Let us see what the outcome would be with feed and cattle at present prices. Without grain feeding a well-bred beef calf born about March 1, would probably weigh about 500 pounds on December 1, and at seven cents per pound would be worth $35.00. The same calf, if fed the feeds named above, would weigh at least 650 pounds and be worth eight and a half cents a pound, or $55.00. These feeds at present farm prices have a maximum value of $11.00. Thus we have $9.00 more per calf as the result of creep feeding. With only ten calves this would amount to $90.00 a year, or at least $12.00 a month for the period over which the calves must be fed. Considering that ten or fifteen minutes a day is sufficient time to attend to creep feeding, we are really very well paid for our labor.

However, like most other jobs, creep feeding must be done well to be profitable. Calves which are fed two days per week and go hungry the other five (or even five days and go hungry the other two), will not have those last few

pounds of finish that will make them bring top prices as fat calves. Instead of weighing 700 pounds at nine months of age they will weight only 600, and instead of selling for eight and a half cents, they will bring only seven and a half cents. Hence, after feed and labor costs have been deducted, there will be little, if any, profit.

Batteries Versus the Floor and Range System

Condensed from The Rural New-Yorker

Clarence E. Lee

IN the past quarter of a century no development in the poultry industry has been so radical as that of chick batteries and laying cages. The battery system has been hailed as the answer to the suburban dweller's prayer; it has attracted the attention of corporations impressed by the possibility of factory management of the poultry industry on a vast scale, and it has likewise been regarded with a great deal of skepticism and a considerable amount of dread by poultrymen already engaged in the business and owning floor and range establishments.

It has been claimed by battery enthusiasts that chicks raised in batteries grow faster with less mortality and that a tremendous number of chicks can be raised in a small room; furthermore, that chicks can be raised with ease the year around so that the plant has a continuous output of broilers, and may sell pullet chicks in various stages of growth or ready to lay, any month in the year. These battery advocates have pointed out that a total investment in land for range and for the proper management of the soil, and in fencing and range shelters, brooder houses, brooder stoves, and all other equipment which is used only during a small part of the year amounts to a large sum. Converting this investment into batteries and battery building, they insist, gives a plant which has a year-around output which requires a very small amount of labor compared with growing the same number of chicks on the range, and actually requires a smaller investment by far for the same production of chicks.

For laying hens a great saving in labor is claimed, much pleasanter working conditions for the poultryman, lower mortality, higher egg production, lower feed consumption. In fact the list of advantages sounds as if laying

Reprinted by permission from The Rural New Yorker, 333 W. 30th St., New York City, Feb. 12, 1938

cages were the long-awaited panacea for all poultry ills.

While there are still unsatisfactory chick batteries on the market, the majority of designs have been highly perfected and the low-mortality record and high-growth rate figures which can be secured with good equipment, good stock, good rations and good management, seem little short of miraculous when compared with the results of some years ago. It is no longer questionable that under proper conditions in batteries, chicks generally do grow faster and more uniformly and with less mortality than birds that are started on the floor.

With these advantages, however, batteries still have decided limitations. No one who has had extended experience with battery chicks would advise anyone to keep chicks in batteries for more than the first two weeks if they intend later to put those birds on the floor or on the range.

As a matter of fact, the writer personally would prefer that they did not start chicks in batteries at all if they were to be put on the floor or on the range later. Our experience has shown that it is exceedingly difficult to prevent disease infection, particularly coccidiosis, where birds are first started in batteries and later transferred to the ground or the floor.

These battery grown birds have made excellent growth and are likely to be a fine uniform looking lot, but they are soft and have not built up any immunity to infection because they have been raised under strictly sanitary conditions where infection has had no opportunity to develop at all.

Experience to date has shown definitely that holding surplus chicks in a hatchery, or for starting chicks to be sold as broilers, or where the pullets are being produced for laying cage plants, the chick batteries are entirely successful, and with proper stock, feeding and management, results are as certain and predictable as in most other lines.

Laying cages have gone through very much the same course of development as in the case of the chick batteries, but the use of laying cages started at a much later date.

There are a number of cages on the market that are well designed and of satisfactory construction.

If the high cost of battery equipment can be reduced by volume sales, and breeders can produce enough stock of superior vigor and vitality that will stand up and do well in the confinement of laying cages, then we may expect the battery system to be of constantly increasing importance. The cost of equipment

has handicapped the growth of the battery system, thus far, especially as regards laying birds.

Aside from the first cost of equipment, the greatest problem for the battery operator is to get stock that will do well in batteries. It is not particularly difficult to get chicks that will grow well in batteries and make fine broilers, but it is not nearly as simple to find strains of layers that will stand up and give heavy production in cages. Many battery operators have been ruined by getting stock of insufficient vigor and vitality or stock that was not free from diseases and parasites.

One of the most common causes of heavy mortality among caged layers is the development of a battery nephritis (kidney disease) which apparently occurs where birds do not have sufficient vigor and vitality to stand the continuous confinement and lack of exercise in batteries. Individual dosage with Iodine Vermicide Merck has helped a few birds, but no effective protection seems to be possible aside from selection of stock with very superior vigor and vitality, preferably from breeders that have demonstrated their ability to live and lay in batteries.

A well-known Michigan breeder of Leghorns who built up a battery plant for market egg production, found that special breeding was necessary and has made such progress in this line that he now is specializing in the production of chicks from parents that have made high records and from families that have low mortality records in the cages.

Very good results have been secured with crossbred layers in batteries, probably due to extra vigor obtained from cross-breeding. Needless to say, such stock will not be satisfactory if either or both of the parent strains were poor layers or had poor livability. Both parent strains must be good stock. A common and satisfactory cross is the Barred Rock cockerel on New Hampshire or Rhode Island Red hen. A rather plentiful supply of such stock exists, on account of its use for the production of broiler chicks, and it is not difficult to find chicks from such stock that have good inheritance for egg production on both sides, and also inherit good livability.

Our observation over the past nine years and definite records at our Research Farm show that no saving in labor of any consequence has yet been attained by housing layers in cages. There is a very large and substantial saving in the amount of labor used to raise chicks and pullets in cages up to laying age, as compared with the usual floor and range system, but after the birds are put into cages it takes fully as much labor as in a modern well-

designed and well-equipped laying-house.

The feeding on the caged plant requires much more time than it does on the floor plant and there is a more or less constant cleaning of the cages required which takes a great deal of time, particularly during hot weather. Failure to attend to this results in an unsanitary condition and the highly objectionable odor which is characteristic on a great many battery plants.

For proper operation of a battery plant it requires more poultry knowledge and skill than it does to operate the average floor plant. It looks so simple and easy that the average beginner thinks there is nothing to it but to follow the simple directions which may be given him by the battery manufacturer. However, it isn't that simple. Where everything is artificially regulated, it requires a considerable background of poultry experience and sound common sense to be sure that the regulation is correct in every detail. Ventilation without draft and with a sufficient number of changes of air per hour, maintenance of the proper humidity in each of the various rooms of the plant, temperature at proper levels in each room, study of each group of birds of various ages to note growth and development or egg production, and detection of any abnormal condition immediately, requires far more study and greater background of judgment and experience than where the birds are turned outdoors and nature takes care of a good many of the essentials.

In brief, the battery system is not simple, it is not a panacea for the problems of the poultry business. It does solve some problems we have had in the poultry business and it introduces others that are peculiar to the battery system alone. It is not likely to supersede floor and range plants as a whole but will do so in areas where land values are very high and where the battery operator is at a decided advantage because of the small amount of land he needs and because he can get close to the market and frequently sell his products the year around right at the door at the very highest prices.

Land Ownership Won't Make Smart Farmers

Condensed from Nation's Business

J. Gilbert Hill

INDUSTRY must have the farm market to exist. Every study proves it. Statistics compiled by the National Farm Chemurgic Council, for instance, show total wages paid by industry each year for the past 15 years are always slightly less than total farm income. That's the business man's stake in agriculture.

Proposals for financing farm home ownership presume that, if a man owns his land—is proprietor of his business, he automatically becomes prosperous and a good customer for industry.

That's silly! Oklahoma, for instance, was opened for settlement April 22, 1889. On that day every man living in Oklahoma was a debt-free landowner. By 1900, in 11 years, Oklahoma had 44 per cent farm tenantry. By 1935 it was 61.2 per cent and it was estimated fully half of the remaining 38.8 per cent listed as home owners were under mortgage. Dust storms and floods have dramatized the farm situation. Little public thought was given the question until people began to dig soil from eyes and ears after a dust storm, or shovel mud from parlors, factories, and stores after floods. When farms—as well as farmers—began to arrive in town, people began to worry.

These casual observers can't miss tenantry with all its abuses, social and economic. It's under their noses. It is under the tenant system that floods and dust storms have swept the country. Then, these observers find, scientific agriculture would conserve most of that soil but science is ignored under tenantry. Therefore, tenantry, and tenantry alone, is responsible. Tenantry must go!

Farmers who go broke tilling the soil don't leave it. They merely turn title to the land over to the mortgage holder and continue to ship fertility away as grain and cotton without setting aside anything for depletion.

Even with this abuse, however, the answer isn't to destroy tenantry unless it is proved conclusively that tenantry is the only factor preventing profitable agriculture and preservation of the nation's resources.

Our agricultural problem must be solved. China failed to solve

Reprinted by permission from Nation's Business, Chamber of Commerce, Bldg., Washington, D. C., March, 1938

hers and the world knows the results. Dr. Peter Nelson, agricultural economist, recently reviewed the success of two other nations, however, in a government publication — England, where agriculture flowered under tenantry; and Denmark, made prosperous by home ownership. We can take our choice, it seems, but close study gives us clues for meeting our own problem.

England once had general farming, producing grain, vegetables, meat, dairy products, and forage. Farms were small. Each unit supplemented income with home manufacturing such as weaving or blacksmithing.

The Industrial Revolution took away the outside income. Cheap and productive land in America and Australia, plus machine agriculture, produced grain for England cheaper than English farmers could produce it. They tried to beat an economic situation. They mortgaged their farms and lost them. They became tenants and the size of farms owned by the aristocracy increased.

These larger units produced meat profitably. Pasture and cheap imported grain fed to livestock became the road to prosperity. Livestock, in turn, provided manure to rebuild soil.

Although England had a traditional pride in mere ownership of land which limited profits, certain tenant abuses developed. A tenant often was not allowed to stay after he had bought fertilizer and worked hard to make the land more valuable.

However, laws were passed to protect the tenant. He won the right to stay on land if he did not abuse it. If the landlord did oust him he could sue for disturbance damages to the full value he added to the land.

Tenants used all their capital to buy equipment. Landlords' returns were small but steady and their *investments were protected.* The English Tenant Act of 1923 codified these laws which are not one-sided. Landlords have plenty of power to remove a poor tenant. They, too, may sue tenants for damage to property.

England also developed an enlightened landlord system supplying managing ability. The English land owner takes an interest and guides his tenant, contrasted with the American investor who too often knows only that "this check isn't as big as it ought to be" when the tenant sells his crop.

Cheap grain from new lands ruined Denmark's foreign markets since Denmark was a grain exporting country. Its soil was depleted. Tenantry was increasing. Denmark had learned, however, that agricultural prosperity required intelligent, trained farmers. She had started a system of agricultural apprenticeship under

the Royal Agricultural Society as early as 1820. When trouble arrived, Danish legislation made it easy for young men, properly trained, to buy land.

Denmark found new markets, too, for pork, milk, butter and cheese and sold to England. The dairy program helped rebuild Danish soil. Nearly a third of Denmark's land became subsistence "farms," providing food and some income but supplemented by industrial jobs.

English tenantry rose to nearly 90 per cent and agriculture succeeded. Danish home ownership was 90 per cent and succeeded. Experiences of these two countries are not held up as perfect answers. But they do prove there is more than one way out of a difficulty. Analyzing both approaches to changed situations these factors emerge:

1. The good farmer is guaranteed continuous tenure.

2. There is definite effort to supply technical information and management ability.

3. Systems of small area farming succeed only where there is a supplementary income.

Application of these principles probably will be easier if we try to see the American picture in a single state. Oklahoma, within its boundaries, has almost every type of agricultural problem which plagues the nation. More important, recent studies and statistics are available. So let's put Oklahoma under the microscope with Denmark and England.

The state is bisected east and west by the wheat and cotton belts. Its eastern section is moist, mountainous and timbered, interspersed with fertile valleys where corn grows well. In the west are high dry plains of range land.

Corn, cotton, wheat and livestock—mountains and plains—water erosion the main trouble in half the state, and seven of 77 counties in the Dust Bowl; 61 per cent of its farmers tenants—that's the picture.

A soil survey by the United States Department of Agriculture reveals that only 20.5 per cent of the state's 44,586,881 acres of farm land had little or no soil erosion in 1934.

On 44.4 per cent of the state's surface three-fourths of the fertility has been washed away. Much land already is abandoned after less than a half century of agriculture.

Where water hasn't destroyed, man has ripped off nature's grass covering so wind could do its worst. More than 15 per cent of the state's surface is affected by wind erosion, 4.4 per cent, or nearly 2,000,000 acres completely destroyed.

What's true in Oklahoma is true in every other section more or less. Tenantry gets the blame. But it all began with land owners.

Oklahoma agriculture also is in the midst of an industrial revolution. Machines are making large farms larger and small farms smaller. Just as loss of markets forced England and Denmark to change methods, so soil losses and low prices are forcing American changes.

The 1935 farm census found 21,337 more farms—an increase of 11 per cent—in Oklahoma than in 1920. However, in 25 of 77 counties there have been reductions.

The reductions came, roughly, where there is least soil erosion and land is smooth, ideal for machine methods; and where erosion has forced farm abandonment.

Population concentrations are those near larger cities where workers, crowded out by depression, have sought to supplement industrial incomes from acreages; and in the areas where land is cheap, no matter how poor.

The movement to cheap small tracts in poor mountain areas is inevitable. There is usually soil enough for a garden. A few fruit trees and berry bushes will grow on the mountain. The slopes may provide pasture for a cow or pig. If a man is lucky and gets a few odd jobs from a wealthy neighbor he is secure.

It is true that in such areas houses are shanties, schools meager, roads poor, and there is inevitable degradation of society. But when a man has tramped city streets looking for work; when he's been hungry and his family suffering; when he's dreamed of cream and pork sausage he knew as a boy, a farm, any farm, is a refuge. Every census reveals cheap lands are being populated faster than any agency can clear them by resettlement.

This is almost exactly the situation prevailing 100 years ago in Denmark. The Danish Government provided education. It trained boys to exist on worn out, worthless mountain land, rebuild it and make it pay. But Denmark also provided outside jobs.

America has begun the education. High school vocational agriculture classes and 4-H clubs will develop educated farmers eventually. Extension workers have done remarkable work in adult education. But ignorant field hands will not learn to conduct a complicated business overnight.

A nation cannot skim all the brains from its rural population to build cities forever; it can't adopt a policy that, if a man fails at everything else, he can always farm and built a prosperous agriture—quickly.

Industrial part-time work will produce far quicker results than education. Industry has been trying to decentralize. In these areas now being settled in spite of everything, industry can find

water, fuel, labor and transportation. Factories eventually will arrive in the "backwoods." Intelligent business can hurry the process so this generation, too, may live a decent life.

This form of tenantry, subsistence farming, has stolen the headlines. But the real problem is the tenant attempting to make all the living for his family on the land and satisfy a landlord.

The rent usually is paid in a share of the crop. It may be cotton, corn, wheat or tobacco. It is always a crop than can be marketed readily because the landlord wants cash. Such forced production of cash crops is the basis of market-breaking surpluses. And, almost invariably, they are those which do the most damage to the soil.

The landlord believes he can't afford to take an indirect return from diversified agriculture. The tenant can't pay cash. Neither will build terraces, homes, or improvements to benefit the other.

The cash crop then, brings this result in Oklahoma—the average tenant lives on a farm 15 months. Three-fourths of them move every year. They've been doing it for generations. They no longer know how to farm.

Probably half the nation's tenants are positive menaces to future prosperity. They never heard of farming methods which are not destructive! On the other hand, the city investor-landlord never knew anything about farming. Many times he's too ignorant to allow even an informed tenant to adopt good practices.

It is here the federal soil conservation program, payment of bonuses from the public treasury for diverting soil depleting crops to soil building—a program prosperous farmers adopted long ago—eventually may pay its cost. Educational results have been phenomenal. They have proved to landlords and tenants alike that rotation is profitable.

But the real value will come from increased production—yes, that's right, increased production even though it is designed to reduce surpluses. Richer soil always produces more abundantly. Abundant production is cheaper production. Lower costs mean that farmers can sell at lower prices profitably. A varied crop program spreads the risk. Prosperity still comes from production.

But the soil conservation program will never suffice. It's too expensive. It's too much a part of our newest national racket of "something for nothing." It's, after all, an after-thought.

It is here that English ideas can benefit us. It is really strange how our "statesmen" have missed vote getting possibilites of legislation to protect tenants. Much shifting of good tenants, because even good ones can't meet impos-

sible demands of some landlords, could be stopped immediately by a "disturbance damage" law.

Legal modernizations cost little. But they would solve the worst of the problem—lack of tenure—bringing better homes, schools, roads, and living conditions; steadier incomes for landlords and more business.

But what is to become of tenants who lack training to carry on a farm operation? The answer is education of landlords. That's where every business man has a job, learning or urging someone else to learn. It needn't take many years to make land ownership a public trust. But, while approaching that, state governments could well afford to adopt simple, economic appeals to human selfishness.

Tax exemption for a woodlot, for instance, would promote reforestation; or tax exemption for abandoned farms for five years while terraces are built and soil re-established—while land is in an unprofitable condition—would get results. The farm isn't an asset to tax rolls anyway unless something is done.

Every American business man has a real stake in agriculture. There are undoubtedly problems of foreign markets, financing, prices and surpluses which must be solved by national legislation. But most of the problem is strictly local.

The tenant problem can be solved, cheaply and permanently, if local business men get down to business.

Pit for Liquid Manure

A North Jersey dairyman who believes that manure is too valuable a product to waste has adopted an interesting plan for taking care of the liquid manure from his herd of fifty cows. He has constructed a concrete pit, fifteen feet long, five feet wide and six feet deep, with a tight plank cover. This pit adjoins the cow barn on the one side and the manure yard on the other.

The liquid manure from both places drains into the pit. From this, it is pumped by hand into a tank wagon which distributes it in a fan-like spray over the fields. —*New Jersey Farm and Garden*

Do High Testing Cows Produce More Fat?

Condensed from Hoard's Dairyman

D. M. Seath and H. C. Dickey

AN unusual amount of attention is being directed today toward the selection of high-testing cows. This is particularly true among the producer-distributors and to a less marked extent among the bulk milk producers. The interest of the various men concerned with selling whole milk has in turn called the matter to the attention of the butterfat producing dairymen. Many of them are wondering how much attention they should pay to selecting for high test.

At the outset let us state that the discussion here will be limited to the problem of selection for high test within the respective breeds, and that no reference will be made to the importance of butterfat test differences between the breeds. We will also admit that the producer-distributors or the bulk milk producers who supply milk for a special market and are compensated accordingly, often have good reasons for seeing to it that their herds contain cows capable of producing milk above a certain minimum butterfat test. Competition or extra remuneration often makes it practical for them to be test-conscious. Will the man selling his product on a total butterfat basis do well to follow the same course?

A fair answer to the above question may be had by considering the relative importance of total milk and butterfat percentage in determining the pounds of butterfat that cows produce. Correlation studies can best answer this question.

If in studying a group of individual cow records it is found that the total fat yield increases in perfect step with the increase in milk without exception, then the correlation coefficient between amount of milk and total fat yield would be +1.00. Correlations can be negative as well as positive. For example, if among a group of individual records the test goes down step by step as the milk yield rises without exception, the correlation would be —1.00. In nature we seldom find correlations which are perfect. Most correlations are relatively small fractions, although occasionally they are large, as is the case between the pounds of milk and pounds of fat which is to be mentioned next.

Reprinted by permission from Hoard's Dairyman, Ft. Atkinson, Wisconsin, Feb. 25, 1938

Recently we had occasion to study 30 Holstein cows, each of which had at least five advanced registry records to her credit. An average of the five records was used as the measure of the cow's production. The average production per lactation for the group was 19,568 lbs. milk and 680 lbs. fat.

A correlation of +0.11 was found between the test of the milk and the pounds of butterfat while the pounds of milk had a correlation of +0.91 with the total yield of butterfat. This study indicates that the amount of milk is relatively much more important than test in the determination of total fat. If this is the rule, then there would seem to be little reason for a butterfat producer to select for high test in his cows, if he must do so at the expense of total milk production.

Some of the cows included in this study did not have their lactation records occur in consecutive years, but had abnormally long rest periods between certain records. It was suggested that test might play a more conspicuous part in determining total butterfat in records of cows which had five records in consecutive years. High producing cows with such records, it was contended, would have about an equal ability to produce milk and the differences in test would markedly influence the total butterfat yield. In an effort to determine the validity of such a contention, 50 advanced registry Holstein cows that met the stipulated requirements were chosen for a second study. The cows' productions were secured by dividing the total yield of each cow by the number of years that the cow had lived between her first freshening and the completion of her last record. This yearly production averaged 14,875 lbs. milk and 524 lbs. fat.

Correlations derived from the productions of these cows showed a +0.20 for the test and total fat while that for milk yield and total fat was +0.91 as in the first study. Milk yield and butterfat test had a correlation of —0.19. If one considers the actual statistical relationship between the three factors — pounds of milk, test, and pounds of butterfat, *the results in this case would show that the milk yield is about two and one-half times as important as is test in determining the total yield of butterfat.*

Lynn Copeland, of the American Jersey Cattle Club, in 1927 reported similar results in studying Jersey Register of Merit records. He found the correlation between fat percentage and total butterfat to be +0.23, and that the percentage of butterfat and quantity of milk had a negative correlation of —0.31. A small negative association between the amount and the test of milk

seems to be the usual rule, for various investigators have found similar correlations.

For example, Dr. W. L. Gaines, of Illinois, reported in 1923 a negative correlation with Holsteins of from —0.11 to —0.40. He found the correlation was —0.21 to —0.50 with Jerseys, —0.30 with Guernseys, —0.14 with Ayrshires, and —0.25 to —0.29 with Brown Swiss. An extensive review of this subject was made by I. J. Krizenecky, of Czechoslovakia, and reported at the World's Dairy Congress at Rome in 1934. His summary of studies by other investigators on European and American dairy cattle breeds shows that the average correlation between milk yield and butterfat percentage was —0.20, and that between milk yield and total butterfat was +0.84.

From the above it can be seen that dairymen who want large quantities of milk and at the same time want a high test have a more difficult task than if test and milk yield were entirely independent. When they secure an increase in total milk they must expect, on an average, that there will be some decrease in percentage of butterfat unless at the same time they select for high test successfully enough to offset the natural tendency for higher milk yield to lower the test. This negative correlation is far from perfect and hence there are some cases (although a minority) where there is an increase in both test and in quantity of milk. The low positive correlation between the test and the total butterfat produced should show the man who attempts to base his selection almost entirely on test that he will increase his total fat production but slowly in this way.

For the most rapid increase in total butterfat production, milk quantity should receive much more emphasis than test. When they are both incorporated into a single figure "butterfat," and selections made accordingly, then the most progress for "butterfat" can be made. In other words, if one is being paid on the basis of pounds of butterfat irrespective of test, herd selection should be on the basis of total butterfat. When this is done, progress will be more rapid than when selection is made on either pounds of milk or percentage of butterfat by themselves.

If he is being paid a premium for high test in addition to what high test brings him directly by increasing the total fat production, then he is justified in paying more attention to test than otherwise. If intelligent selection is to be possible for total fat, a herd owner must have continuous milk as well as fat test records on his herd. Herd testing of one form or the other furnishes the best type

of records for the making of such selections. This is particularly true because it is desirable that the average of several years' butterfat production be used as a guide. Under such conditions the influence of environmental changes causing yearly variations will be minimized and one will be able to more nearly select on a "productive butterfat" basis.

Horse Doctors

Condensed from Horse & Horseman

Henry A. Du Flon

THE popular conception of the old-fashioned veterinarian was that of an ill-paid, shabbily clothed, bewhiskered old man, who shambled around the countryside with a knife, a needle, a ball of twine thrown together in the back of his gig.

The "vet" was pictured as a cross between a butcher and a mid-wife, whose main work consisted of castrating hogs, opening abscesses, assisting at calf deliveries. Crediting this picture to minds equally old-fashioned, we wanted a closer view of this profession, which still is referred to as a stagnant branch of medical science. We wanted a good look at this man accused of using medieval methods in a modern age.

What education do the modern schools of veterinary medicine provide? How many schools are there? What sort of person is the modern veterinarian?

The typical veterinarian today is an intelligent, middle-aged, fairly prosperous man. If he lives in the country he earns up to $5,000 a year; if a city veterinarian, he makes close to $6,000. There are no highly paid specialists among veterinarians, but their average income is about the same as that of doctors for humans.

The 11,500 animal doctors now practicing in the United States form about one-third of the total number of veterinarians in the world. Although this is a larger percentage than ever before, Germany, France and Great Britain, with a total of only one-half our horses, two-thirds our cattle and three-fifths our swine or sheep, have more schools of veterinary medicine than the United States and very nearly double the number of practicing veterinarians.

Granting the probable presence of unnecessary duplication in for-

Reprinted by permission from Horse and Horseman, 1270 Sixth Ave., New York City, Feb., 1938

eign practice due to smaller political areas, it would appear on the surface that veterinary medicine has in comparison been a little too much neglected in America.

The American Veterinary Medical Association, organized in 1863, comprising about half of the practicing veterinarians in the country, is the practical governing body for the profession.

This association sponsors successful conventions, where veterinarians talk shop, slap backs, read scientific papers and gravely ponder such professional problems as the growing breach between sturdy practitioners on farm animals and effete city doctors who favor socialites' pets, and it also communicates with its members upon recent developments in medical knowledge and technique through its official monthly magazine.

Veterinary practice may roughly be divided into four categories, according to the type of animals involved. It deals 38% with cattle, 24% with pets, 18% with horses, 14% with swine.

The leadership of the four is quite understandable in economic terms. Not only do the 5,000,000 owners of American cattle, swine and sheep realize the dollar and cents value of scientific medical advice and treatment for their flocks and herds, but the government spends much time and money in protecting these industries as vital to man's economic needs. The United States Department of Agriculture's Bureau of Animal Industry is the largest employer of veterinarians with 1,350 on full-time regular work, 630 on full-time emergency work, 1,210 on part-time emergency work.

Nor is it hard to explain why pets have become the second largest group. There are a great many pets (there are estimated to be 15,000,000 dogs in the country and 13,000,000 cats!) and their owners can generally afford medical care. Without a doubt the most prosperous veterinarians are those who specialize in "small animals." The United States has some 2,000 of these specialists; their best clients are the professional dog breeders and the owners of pets raised in the unnatural conditions of the cities.

The first school of veterinary medicine was founded in France in 1761 to train men to save war horses. The first school in the United States was founded as a private institution in New York in 1857; since then the place of the private professional schools has vanished.

Today there are only ten recognized schools of veterinary medicine in the country—all of them departments of state universities or colleges. Best known are found at Cornell, the University of Pennsylvania, Ohio State and

Iowa State Universities. State requirements vary, but the general rule is that a student must complete one year of college, attend a school of veterinary medicine for four years, get his diploma, and pass a state examination before practicing.

In 1916, there were close to 3,000 students in the then numerous schools. In 1926, the number of schools had been more than cut in half and there was an enrollment of but 502 students. 1938 finds no additional schools, but enrollment is climbing back to the 1916 level.

Probably the Bureau of Animal Industry has done more to improve the veterinary profession than any other one factor. Employing, as it does, in its health and livestock work, about one-fifth of the veterinarians in the country, the Bureau has naturally been able to effect an important change in professional standards. By Civil Service examinations the Bureau has been able to weed out low-grade colleges, and has helped replace charlatans with qualified young men.

The Bureau maintains lists of accredited and approved veterinarians. These are private practitioners, who, by examination or otherwise, have demonstrated their ability to perform certain classes of work to the satisfaction of Bureau standards. An accredited veterinarian is of higher grade than an approved veterinarian, and any citizen, writing to the Bureau in Washington, may learn the names of accredited and approved vets in his locality.

The Bureau's leadership in planning and conducting disease-control cannot be denied. The United States has become the safest country in the world in which to breed and raise domestic animals. The Bureau has skilfully, quickly, efficiently renovated branches of the profession to insure this record.

The Bureau of Animal Industry is so organized that the efforts of every type of research scientist have been co-ordinated for disease eradication. Health statistics seem to prove that highly organized research directed at a definite end gains results. So thoroughly has this branch of veterinary medicine been organized that American livestock is well protected against any pathological condition preventive medicine can eradicate.

The progress of veterinary science has been conditioned, like the progress in many other professional fields, by economic demand. Where there has been sufficient demand for improvement—where the definite need has not only been felt but voiced—a more intensive research and knowledge and an improved standard of technique has been the result.

It is not mere chance that the Bureau of Animal Industry provides a splendid example of efficient organization, nor is it mere luck that the veterinarians it employs have achieved a remarkable record in keeping American livestock disease and loss at a low minimum. The production of meat, milk, and wool are vital industries; it is economically important for the welfare of the country that they be protected. It is economically necessary to insure against an animal loss—and against loss by disease transmissible from animals to humans.

Little work has been done to improve knowledge concerning horses in the past thirty years. Does this mean that there is no need for improvement? Decidedly not. Each year there is a tremendous economic loss resulting from diseases affecting horses—and horses are still the most valuable livestock in the United States. The estimate of the Department of Agriculture for January 1, 1937, reports that the value of horses and mules amounts to nearly $1,750,000,000—more than twice the value of hogs and sheep combined and more than the value of all milk cattle.

Despite their value, horses are still troubled with the same skeletal diseases, the same eye disorders and the same respiratory troubles that plagued them three or more decades ago. Some of the infectious diseases have been stamped out, several of the worst remain. For this condition, there are four reasons:

1. Improper realization of the value of the modern horse, leading to

2. The common idea that the horse is a luxury, not worth the funds for medical study;

3. Lack of concentrated demand for an improvement in vetinary work, due to the scattered ownership of horses, and

4. Lack of monetary incentive in the equine field for the veterinarian.

When the delivery wagon gave way to the Ford, when the driving horse passed from view and tractors started to supplant the draft horse, when armies began to move in tanks, government and state schools considered it foolish to spend money keeping equine medical science abreast of the times. The horse was going out. People did not realize that in 1938 the horse would be found on more farms, in more parts of the country, than any other livestock. Even if they had, it would not have been worth while for vets "to fool with horses"—there just wasn't enough money in it.

A New Way to Measure Internal Quality of Eggs

Condensed from American Poultry Journal

Emil G. Glaser

A new and practical commercial method of measuring the internal quality of an egg has been worked out by Dr. H. L. Wilcke, head of the Department of Poultry Husbandry, Iowa State College. It eliminates the human element that accompanies candling and at the same time is much quicker than those methods that call for breaking out and measuring the contents.

This new method involves the use of an apparatus patterned after the torsion pendulum. It is a ring-stand device fixed so as to induce a period of vibration when an egg is placed into an egg-shaped metal collar which hangs suspended between two piano steel wires. A mirror reflects the vibrations in swinging motion on the wall between three marks, the center one zero.

In this way the exact quality of the total internal contents of any egg may be ascertained by the time it requires the vibrations to come to a complete zero as registered down to the very last vibration by the reflection on the wall.

The thinner the contents of the egg, or the lower the quality, the longer it requires the swinging motion on the wall to come to a complete halt.

Called the "K" Value

In order to establish a definite measure of value for this method of determining the internal quality of eggs, Dr. Wilcke decided to call it "K." Thus it might be said that the "K" value of an egg is the degree of its internal quality. This measure is further substantiated by pointing to the fact that the weight of an egg and "K" value are closely associated. Thus the thicker the albumen and the more rigid the yolk, the better its "K" value.

In practical application, eggs from 5 pens of S. C. White Leghorns were measured, the object being to determine whether the differences in the eggs produced were due to the rations fed or to the individuality of the hens. The hens in one of the pens were inbred, which suggested another study—that of determining the difference between the eggs from birds not inbred and those which were inbred.

Reprinted by permission from American Poultry Journal, 536 S. Clark St., Chicago, Illinois, Feb., 1938

The results showed that there is really a highly significant difference in the "K" value of eggs produced by different hens, and that it is this variation in individual hens rather than the ration that causes the various "K" values or degree of internal quality. The feed used consisted of a basal ration of grains with protein supplements of dried milk, meat and bonemeal, soybean oil, and corn gluten meal, which are essentially the ingredients of any good mash.

The Method Has Advantages

In the inbred sisters, the "K" values of the eggs were much less variable than in the non-inbred pens, indicating that inbreeding, by reducing the difference in the birds, is conducive to influencing a more uniform quality in the eggs produced by such birds.

It is pointed out that this method of determining the total internal quality of eggs eliminates the necessity for breaking the egg and thus making it impossible to measure the egg contents as they exist in the eggs; it provides a means of measuring those qualities which actually influence the commercial grading of eggs; it is convenient and rapid; it can be duplicated readily by others; and, it is precise because of the ability to duplicate the results at will within a reasonable degree of accuracy.

Unless Fertility Loss Is Figured We Short-Change Ourselves

Condensed from Missouri Ruralist

G. H. Howard

WHEN we come to figuring what corn costs there is something we are likely to overlook. If we consider how a crop drains fertility, and what it will cost to replace that fertility, we will readily see the necessity of conservation measures and perhaps of the need of more manure and fertilizer.

As an example of how to solve this problem we want to present the figures and experience of Jake Berkes, who last year produced a yield of 131 bushels of corn to the acre on 10 acres. His 10 acres were entered in the Ilinois production contest. But yield accounted for only 60 per cent in awarding the championship. The remaining 40 per cent considered in the award took into account freedom from disease, barren stalks, missing hills, "standability," market grade and cost of production.

Most of us have a fair idea of the production costs for labor, taxes and rental of ground. Mr. Berkes' costs for these items amounted to: Man labor, $5.28; horse labor, $1.61; tractor use, $11.47; machinery charge, $7; seed (hybrid), $13.35; overhead, $1.16; harvest, $65.50; taxes, $10; rental of land, $60—or a total of $175.37. That made his acre costs a little higher than $17.53 an acre, which in itself isn't bad at all.

But a copy of Mr. Berkes' production figures, attached to his grand championship award at the corn show during Illinois Farmers Week, listed his production costs at $275.57 on the 10 acres, or $27.55 an acre.

The fertility the corn removed from those 10 acres was counted against the crop. Since the stalks stayed on the field no deductions were made for them, the stalks presumably being turned under before the succeeding crop.

In those 1,310 bushels of corn there was $62.50 worth of nitrogen removed. The corn took off $22.26 worth of phosphorus. The loss of potash amounted to $12.44. These amounts are the costs of these three plantfood elements at current market prices.

Reprinted by permission from Missouri Ruralist, 2206 Pine St., St. Louis Mo., Feb. 5, 1938

To offset these costs there must be deducted the value of 700 pounds of a 2-12-6 fertilizer which Mr. Berkes applied to the hill, but the cost of the fertilizer he used was little more than $10. In other words, for the season of 1937, Mr. Berkes added $10 worth of plantfood and took out $100.20 worth of plantfood. He still owed his 10 acres at the end of the season about $90 worth of plantfood, or was short in his accounts with his land $9 an acre.

If 20 pounds of phosphorus are removed, this would be the equivalent of 100 pounds of 20 per cent superphosphate. If 40 pounds of nitrogen are removed, such would be the equivalent of 200 pounds of 20 per cent ammonium sulphate. Twenty-five pounds of potash would be the equivalent of 50 pounds of 50 per cent muriate of potash. Thus a 50-bushel crop of corn removes (without stover) 50 pounds of nitrogen, or the amount contained in 250 pounds of ammonium sulphate.

The figures should be impressive because they bring one up with a jerk in realizing the heavy drain of plantfood which crops remove.

Without doubt it is this removal, without replenishing, that has given crop disease a better footing, has caused such disastrous results in attempting to get good clover stands, and explains why we sometimes think soils and crop experts are a bit too rabid when they point out the necessity of rotations, of diversified farming, of green manure, of pasture, of livestock farming and of the use of fertilizer and lime.

And while looking at the figures of what crops remove in the way of fertility, we might see what livestock does.

Where a 50-bushel crop of corn removes 50 pounds of nitrogen, a 1,000-pound steer removes only 25 pounds; 1,000 pounds of hog remove only 18 pounds of nitrogen; and 10,000 pounds of milk remove only 57 pounds of nitrogen.

As to milk, this means that a cow producing 10,000 pounds—which is pretty good production for an average Jersey or Guernsey, removes only 7 pounds more nitrogen from the farm than a 50-bushel yield of corn from an acre. No wonder livestock farming comes under the head of conservation.

In most cases the cost doesn't come out of your pocket with one crop. There still is considerable fertility or plantfood in the soil for farmers to draw on, but it means that depletion of fertility is a constant thing.

How Grazing Associations Work

Condensed from The Western Farm Life

W. B. Mabee

ACCORDING to my way of thinking, the greatest hope for the solution of most of the major problems in the Great Plains (and we have major problems) lies in the development of grazing associations.

After many adventures and gambles with land grants, policies, homesteading, immigration, non-irrigated farming, large-scale, low-cost wheat production and summer fallow, even the most skeptical now will admit that there are large areas of the Great Plains that are best suited to livestock purposes.

A long time ago, when we thought the going was getting too tough, the fences too many, the plowed fields too close together, I was gathering for our last round-up. We hade to sell— there was no more range. I paused on my horse and talked at some length to a good farmer who was setting a corner post for a fence around his newly-broken field. During the course of the conversation he said in effect, politely but definitely:

"You old-timers don't like to see these fences and the plowed land; you want it all for your range. This is good, level land, there is no clearing to be done, it will produce more in crops and more people can live in the same area."

For a good many years I guessed maybe he was right.

Not so long ago as a member of the North Valley County (Montana) Co-operative Grazing Association, I sat on the same horse at the same corner, saw the slight depression that was a cellar and a pile of rocks at the corner. The needle and grama grasses — oh, so slowly — were coming back among the weeds. I marveled at what changes can take place even in the lifetime of one good saddle horse. This farmer is now on a good piece of land. I am again grazing cattle and his land is coming back to grass. We all got in each other's way, and we all had to start over.

Grazing associations will prevent such things happening again. They will (1) stabilize the livestock industry, (2) will put land to its proper use and conserve our great natural resource — grass, (3) will eliminate competitive

Reprinted by permission from the Western Farm Life, Denver, Colorado, March 1, 1938

bidding on key tracts of land so the stockman can secure range at a price he can afford to pay, (4) will weld together under uniform use our checkerboard land ownership pattern, and (5) will bring to all land-owners or land-owning agencies a steady revenue for all lands.

The order in which these points are listed will depend on the point of view. A stockman will list stabilization and reasonable grazing costs at the top. A real estate man or landowner will think of the income from all land, and a conservationist will look longest at proper land use.

It was the first reason, "stabilization of the livestock industry," that brought those first seven of us together in North Valley county, Montana, although we didn't think of it in that way at the time. We wanted grass and water for our cattle—even if we had to pay for it. And if we did pay for it, we didn't want someone else getting one-half to two-thirds of the grass before we turned out. We also wanted to control our range and to manage our own business without too much dictation from government officials, who perhaps didn't know our conditions.

Our land roughly encircled a range area, composed of abandoned homesteads, county land, state land and land belonging to non-resident mortgage holders. For years each had leased parts of this range and all ran their cattle in common. There were, however, gaps between ranches and between leases that permitted ingress of outside stock.

We talked, I guess, almost a year, at branding, at dehorning, at haying and at wood sawing about trying to lease it all and fence up the gaps. At last we held a few meetings, first at one ranch and then at another, drawing up a constitution, by-laws and rules.

Considerable time then elapsed while we made ownership plats, looked up tax records, found out who really owned the land and agreed on our rules of the range.

About this time things began to happen. The new county agent became interested. The Montana state grazing law and the Taylor grazing act were passed. The RA began to purchase land, and grazing associations sprang up all over the county, there being some 17 at one time in our county. That one winter our milk cows almost dried up, we were away so much attending grazing meetings, arguing about boundaries between associations, and with the Taylor grazing people.

Finally we decided to merge all associations into two larger ones.

Without going into the details of our constitution and by-laws, our association works something like this:

Each member in good standing has one vote and yearly we elect one director for 5 years.

The board hires the secretary and instructs him in leasing grazing land, issuing permits, collecting grazing fees and conducting the business of the association.

The association does all land leasing, the members having agreed not to bid against each other or the association for grazing leases. Since the amendment to our state grazing law, which created the state grazing commission, all associations must control 51 per cent of, and must make a fair offer for all grazing land within their boundaries. This system eliminates competitive bidding on water holes and key tracts and the so-called stealing of range adjoining them. All tracts bring in a fair income to the owners, and the complex ownership is welded together under one management which stocks the land according to the amount of stock it will carry. This conserves the grass and eliminates over-grazing of some areas.

Grazing permits are allotted to members according to their prior use of the range (during our base period from 1930-1934) and their commensurability. That is, according to their ability to care for their stock the four months when they are not run on association-controlled lands.

Every member is given an individual allotment of range and provision is made for necessary reductions in stock, should the carrying capacity of the range not be sufficient.

When a stockman can depend on having the same range year after year and knows that no one will move in on him or outbid him, it stabilizes his operations. He is willing to pay a fair price for his grass and if necessary, to reduce his numbers when he knows he will have grass each year.

In the commensurate ratings established, hay- and feed-producing lands rank highest, and the poorer the production the lower the ratings. Cash crops rank lowest. This naturally discourages cash-cropping submarginal land and gradually brings the land to its proper use. The long-time leases held by the association discourage suit-case farming and speculative ventures which play havoc with an otherwise stable community.

The association rules deal in detail with every contingency that may arise — breed, quality and number of bulls, crossing and trailing privileges, preferences, protective limits, non-use permits, privilege to increase, reduction limits, fees and many other points that come up in livestock management.

The association charged $1.00 an animal unit in 1936 for 8

months' grazing, gave its members a refund of 25 per cent, and still came out with a substantial balance in the treasury, with no unpaid bills. Seventy-five cents an animal unit for 8 months' grazing suits me. In 1937 we paid in 60 cents an animal unit and probably will not have to pay any more.

But before the association was formed my costs for 8 months' grazing, including the land I could just sort of use, amounted to $2.20 an animal unit, so I am well satisfied with the 60 to 75 cents.

We have our troubles, our protests, our arguments with the department of the interior and land companies about lease rates. But our troubles are surprisingly few, when you consider the land we manage and the number in our membership.

New Models in Pasture Plants

Condensed from The Southern Planter

D. B. Johnstone-Wallace

Assistant Professor of Agrostology, Cornell University

THE development of pasture research has lead to a search for new models in pasture plants which possess superior qualities. The search is rendered difficult because there is no simple way in which desirable pasture characters can be recognized in single plants.

The improvement of pastures, whether it is by fertilization, grazing management, the sowing of seed, or a combination of these, has as its object the establishment of a pasture which will enable a grazing animal to consume during each day of the grazing season the maximum amount of feed of a chemical composition suitable for the maintenance of health and for the production of the product desired.

With this object in view the first step in all pasture improvement is the raising of the fertility level by suitable fertilization to the stage where desirable plants can grow and compete successfully with undesirable plants. The plant breeder can accomplish little by developing plants which will grow at a low level of fertility. Such plants may grow well for a time on poor soils but the more they grow, the more plant nutrients they remove and eventually

Reprinted by permission from The Southern Planter, 223 Governor St., Richmond, Va., Feb., 1938

they are replaced by other plants adapted to a still lower fertility level.

Fertilization and good grazing management together can lengthen the grazing season, increase the yield and improve the feeding value of the herbage, and result in greater uniformity of production throughout the grazing season. The selection of improved types of pasture plants can carry the improvement still further in the same directions.

Before the plant breeder attempts the production of new models in pasture plants he must look over the old models to find what desirable characters they possess. He must also look for the models which have stood the test of time and have been found to render good service. The place to find good pasture plants is in a good pasture, which has been properly fertilized and grazed and which has given good returns in terms of milk, beef or other desired product.

One of the first plant breeders to appreciate the importance of good pastures as a source of good pasture plants was Professor R. G. Stapledon, Director of the Welsh Plant Breeding Station at Aberystwyth in Great Britain. Plants brought in from the famous pastures of Kent, Leicestershire, Devonshire, and other counties of England were found to differ considerably from those produced from commercial seed of the same species. The types found in old pastures, which Professor Stapledon has called "pasture types," are usually extremely leafy, short rather than tall, frequently possess a procumbent or creeping habit of growth and are apparently designed by nature to withstand close grazing; that is to say their leaves are so produced that complete defoliation by a grazing animal is almost impossible. While they are less productive than hay types when grown for hay, they are more productive when cut frequently, and, what is most important, they are able to survive permanently under grazing conditions. Commercial types in contrast to pasture types are usually erect in habit of growth; they lack leafiness and they are heavy yielders of seed. Frequently, they lack persistence under grazing conditions.

Wild White Clover Valuable

In the pastures of the northeastern states, as in the pastures of Great Britain and much of Europe, the most valuable pasture plant is wild white clover. This is a wild form of the commonly cultivated white Dutch clover from which it differs by being smaller in the leaves, later in flowering, possessing a more vigorous creeping habit, and most important of all, by being a true perennial, whereas plants of commercial white Dutch clover sel-

dom live more than two or three years. The first investigator to realize the significant difference between wild white clover and white Dutch clover was the late Professor Douglas A. Gilchrist, of the University of Durham, in England. His experiments at Cockle Park lead to the first large scale use of a special variety of a pasture plant for the improvement of pastures, and today a large amount of seed of wild white clover is harvested from old pastures in Kent and certain other counties in England.

Experiments at Cornell University have shown that the use of wild white clover in place of white Dutch clover under New York conditions makes a tremendous difference in the type of of pasture produced and in its productivity. Pastures seeded in 1932 have continued to yield from 2 to 3 tons of dry matter per acre containing about 30% protein each year when wild white clover was included in the mixture, whereas those seeded with the same grasses without the wild white clover have yielded less than one-half ton containing about 18% protein. Plots seeded with white Dutch clover have yielded well in the first year but the clover has almost completely disappeared by the third year with consequent reduction in yield and encroachment of weeds.

The great value of wild white clover in a pasture lies in its ability to supply economically the large amount of nitrogen required for high productivity. It also influences soil temperature, controls erosion, increases the absorption of water by the soil during heavy rains and improves the feeding value of the herbage. The type of wild white clover found persisting in old well-grazed pastures in New York State is very similar to the wild white clover found in English pastures.

Studies On Ryegrass

Another plant of great value in improved pastures is perennial ryegrass which after wild white clover is the most important pasture plant in English pastures. The wild forms found in old pastures are true perennials, whereas many of the plants produced from ordinary commercial seed live only one or two years. The wild forms are also more leafy and more productive under grazing conditions. Professor Stapledon has produced a valuable strain known as S23 which is giving excellent results in England. In New York State the climate is too cold in the winter for most varieties of perennial ryegrass with the result that it has not been possible to take advantage of the merits of this grass in pasture improvement until recently. Investigations at Cornell University have shown that considerable difference in winter hardiness ex-

ists between different varieties.

Three varieties of Scandinavian origin have been found most suitable for New York conditions; they are the Swedish Svalof Victoria perennial ryegrass, one of the first improved strains of grasses introduced by the famous plant breeding station at Svalof in Sweden. Another is the Norwegian Jaedersk variety, and the third is the Danish E. F. 79 produced by the Otofte Plant Breeding Station near Copenhagen in Denmark. These new models have made it possible to add perennial ryegrass to the list of grasses adapted to New York State.

A Creeping Timothy

Timothy has received considerable attention at the hands of the plant breeder in this country but hitherto he has thought of it only as a hay plant and many improved hay strains have been produced, although none has become widely used. Dr. Jenkins, of the Welsh Plant Breeding Station at Aberystwyth, was the first to devote attention to pasture types of timothy; his first introduction is known as Aberystwyth Pasture Timothy No. S. 50. This variety is entirely different from commercial timothy in its habit of growth. The plant is small, seldom exceeding one foot in height; the leaves are narrow instead of broad and they lie close to the ground instead of erect. The plants spread by stems which root at the nodes as they travel over the ground, especially under grazing conditions, and the sward produced is extremely dense and leafy with an appearance much more like a Rhode Island bent lawn that a sward of commercial timothy. Under close grazing conditions this variety of timothy, when grown with wild white clover, has been found highly productive and it possesses many desirable characters which have earned for it a place in the Cornell Pasture Mixture.

Another plant which promises to be of great value in the northeastern states is a wild variety of birdsfoot trefoil (*Lotus corniculatus*) which the writer was fortunate to discover during a pasture survey of Columbia county, New York, in 1934. Birdsfoot trefoil is a yellow flowered legume with a deep taproot and it is found in pastures throughout Europe. Two forms are commonly obtained in Europe, the ordinary commercial variety with an erect habit of growth and large leaves and flowers which is often used in seed mixtures in France and Germany, and a small wild form separated from English wild white clover seed as an impurity. The New York type differs from both of these. The leaves are longer and narrower and the plant is much more vigorous in its habit of growth. Single plants have

been found with stems lying along the surface of the ground and covering a circle of more than six feet in diameter. As a highly productive, palatable, and drought resistant legume, this variety of birdsfoot trefoil possesses outstanding merit. Farmers have already begun harvesting seed and it is hoped that commercial supplies will become available during the next few years.

Creeping Red Fescue is another plant which has received attention at Aberystwyth both for pasture and lawn purposes and a valuable strain known as S59 has been produced. New York also has an excellent wild variety which occurs in the northeastern part of the State. It possesses a very vigorous creeping habit of growth and has been found to be highly productive under close grazing conditions.

Bluegrass Being Studied

Kentucky bluegrass has received some attention from plant breeders in this country and in Canada but so far no supplies of seed of the improved strains produced have been available. In Denmark, Sweden and Great Britain, varieties have been introduced which have been found to be more productive than commercial stocks in experiments at Cornell University. These are undergoing further investigation so that use can be made of them if they are found to give good results over a period of several years.

Orchard grass has been the subject of much investigation. About 1911, the late Professor D. A. Gilchrist in England discovered that orchard grass of New Zealand origin gave rise to superior pasture plants. The New Zealand plants were very leafy and late in flowering and produced a desirable type of pasture, whereas, the commercial Danish seed gave rise to tall stemmy plants which flowered early and which were very unsatisfactory under pasture conditions. It was found that the New Zealand seed was harvested from old pastures which owed their origin to the hayloft seeds brought from Great Britain by settlers many years ago. These hayloft seeds were from old meadows in Great Britain and the type of orchard grass present was similar to the wild type found in old pastures. New Zealand orchard grass, therefore, is a wild pasture type similar to that found in English pastures. Unfortunately, in New York State the pasture types have been found to be somewhat lacking in winter hardiness in severe winters and further investigations are in progress to discover strains better adapted to the State. For states farther south it is highly probable that New Zealand, and several of the Aberystwyth varie-

ties of orchard grass will be found of great value.

Meadow fescue, alfalfa, alsike, lespedeza, yellow trefoil, red clover, and many other forage plants are receiving attention in the plant breeding stations of the world. There is need for more testing of existing new and wild varieties under grazing conditions with a view to determining the characters desirable in new varieties which can be produced.

The utilization of new models of pasture plants by the farmer is taking place slowly. In order to bring it about, the first step is experimental work to determine the way in which improved strains can be used to advantage and to select those found to give the most satisfactory results. The second step is educational as it is necessary to create a demand on the part of the farmer for improved varieties before the seedsman will endeavor to stock them or the seed grower will endeavor to grow them.

The problem has been solved in New York State by the development of what is known as the Cornell Pasture Mixture. This mixture is intended for the production of permanent pastures and is the result of experiments which were commenced in 1932. The ideal aimed at has been a mixture capable of yielding 30 pounds of dry matter per acre per day throughout a grazing season of six months if the herbage is removed whenever it reaches a height of about 4 inches. Uniformity of production throughout the grazing season has been considered of greater importance than total yield, and ability of the plants to persist under grazing conditions has been considered preferable to the production of higher yields for one or two years. As the experiments progress the mixture is gradually improved so that the model for 1938 differs slightly from the 1937 model. Further improvements are contemplated in 1939 and 1940 when supplies of seed of desirable new strains are expected to become available.

The Cornell Pasture Mixture for 1938 in its best form consists of the following:

Kentucky bluegrass (*Poa pratensis*)	8 lbs.
Canada blue grass (*Poa compressa*)	2 lbs.
Rough stalked meadow grass (*Poa trivialis*)	1 lb.
Aberystwyth Pasture Timothy No. S. 50 (*Phleum pratense var.*)	6 lbs.
Swedish Victoria perennial ryegrass (*Lolium perenne var.*)	5 lbs.
Kent wild white clover (*Trifolium repens var.*)	1 lb.
Commercial yellow trefoil (*Medicago lupulina*)	2 lbs.
Total (per acre)	25 lbs.

Because of the scarcity and high price of some of the selected strains, a list of alternative varieties which may be used is given. In place of Aberystwyth pasture timothy No. S. 50 other varieties in order of preference are Cornell 1777 and Cornell 4059 hay timothies, Aberystwyth S48 and S51 pasture-hay timothies, and lastly, commercial and other varieties. The same procedure is followed with the other constituents.

A Job for Each Section

It is intended that commercial yellow trefoil will be replaced by New York wild birdsfoot trefoil as soon as supplies of seed are obtainable in sufficient quantity, and eventually improved strains of Kentucky bluegrass will be used. Little work has been done with Canada bluegrass and rough stalked meadow grass and although they perform a useful purpose in the mixture it is possible that they may eventually be replaced by new strains of other species. A search is proceeding for grasses and legumes able to make more growth during the period extending from mid-June to mid-August. Plants are required able to grow at high soil temperatures and resistant to drought. The grazing season may be extended if frost resistant grasses able to grow at low temperatures can be found or developed.

The mixture is adapted only for conditions of high fertility and New York farmers are recommended to apply the equivalent of 800 pounds of 16 per cent superphosphate per acre before seeding, and to repeat the application at intervals of 4 years. Acid soils testing below pH 6.0 should receive lime also and some soils require potash. The mixture is seeded without a nurse crop, preferably in early April under New York conditions, and it is grazed in the same year. Good grazing management is essential as the wild white clover is intolerant of shade and must be closely grazed periodically.

The problems of New York State are not the same as those in other states. Changes in climatic conditions, in soil types and types of farming make it necessary to vary the composition of the mixture and to change the strains used. This will involve experimental work and while the Cornell Pasture Mixture may form a good starting point for investigations it is probable that mixtures will be found which are better adapted for use farther south.

A New Treatment for Mastitis

Condensed from Guernsey Breeders' Journal

Robert Roemer

ONE day this past summer an eastern dairy specialist told a group of western dairy cattle breeders that the most toll-taking thing in all dairydom was mastitis. The Guernsey man's first reaction was one of disbelief. Not a case for many years, and a sanitary program seemingly checking the disease, gave a feeling of security. So, a questioning attitude was taken toward the speaker, who, however, stayed by his statement, insisting mastitis infection was latent in all dairy herds, awaiting only favorable opportunity for a disastrous flare-up.

I had heard one rumor that Oscar Erf, at Ohio State University, had been doing work on treating mastitis with the new medical wonder, sulfanilamide. Professor Erf's son, a doctor of medicine, had watched the successful treatment of streptococcic infection in humans with the sulfanilamide. He had suggested to his father that this drug might be of considerable value in combating streptococcic mastitis in dairy cattle. Professor Erf, I later learned, had recent and gratifying results from treating new and acute cases with this drug of coal-tar dye origin.

At the end of the summer, bad sores broke out on the teats of some of my cows and heifers, coming from particularly malignant fly bites. We milked the affected beasts last; and bathed and treated the teats with chlorine solution and an iodine ointment.

One of these cows, The Elms Lassie 193815, has been on test continuously since the inception of the Guernsey Herd Test some eight years ago. For long-time production in the herd test for that period, she would probably rank second with a lactation-after-lactation average well above 600 pounds of butter fat. I had to go down to eastern Nebraska for a few days, and when I returned this valuable Guernsey was one of the sickest beasts I have ever seen. Her temperature was approaching 107 degrees. She had stopped eating entirely. Her milk production had dropped from over over thirty pounds a day to almost nothing. Her hair stood on end and her eyes were dull and glazed. Her udder felt as if it had been poured full of a cement mix

Reprinted by permission from the Guernsey Breeders' Journal, Peterborough, N. H.

and allowed to set to rock-like hardness. Cow men will recognize it instantly; it was an acute attack of mastitis, with the infection from the fly bites going up the teat canal.

There was no use handling this attack with injections of this and that, and bathing and rubbing, and sweating the udder with hot blankets, and stripping every hour, and all the other foolish and futile things which dairymen had been trying so desperately and unavailingly in other years—while some valuable animal lost a quarter, or died. I got Dr. Scott, our veterinarian, out at once, adding to his knowledge the little I knew of Professor Erf's work at Ohio State University with the sulfanilamide. At once he was busy by long-distance telephone, and soon had a supply of the drug.

We began treatment at once. By morning the temperature was dropping, and, by evening, twenty-four hours after treatment had begun, it was normal. "Elms Lassie" began to be interested in feed, and soon was really hungry. In thirty-six hours after the first dose the milk was clearing up of infection signs, with an encouraging flow beginning to come. In seventy-two hours it was back above eighty per cent of the amount given before the attack had come on, with Dr. Scott soon thereafter finding the milk negative to mastitis reagents. And, best of all, the fevered and rock-like udder was hanging limp and silky and cool.

To me this was miraculous. Yet I knew one swallow did not make a spring; and that a remedy for one case did not constitute a cure. We had not long to wait for further proof. A heifer had one of these malign fly-bites develop exactly over a teat-opening. There was no preventing the infection going up the teat canal like a draft up a chimney. The flare-up was instant, and bad. But we were ready with a supply of the sulfanilamide, some previous experience, and a recent letter of instructions from Professor Erf. The case, never obtaining headway, came quickly under control.

Paul De Kruif says the credit for starting laboratory and medical workers on the sulfanilamide trail should go to a German dye concern, the Farbens of Elberfeld. But, remember, that even in trained hands, it has proved a tricky and dangerous drug, and deadly to human life where competent men were not administering it. Also, remember well, that during the course of treatment no other medicines of any sort, even to common salts for physic, should be given. Sulfanilamide forms poisonous compounds readily with many things.

So, it would be well for readers to talk this thing over with their

veterinarians. Secure from your veterinarian a supply, with approximate dosage prescribed to be ready to combat an instant and surprise attack—for that is the way mastitis strikes. For a 1500-pound cow a dosage which worked for us was twelve of the 15-grain tablets daily, or a total of 180 grains, at the peak of the infection, with a gradual tapering off from this amount as the case cleared up. This amount was divided into three doses, of four tablets each, for morning, noon and night. Each dose of four tablets was crushed and partially dissolved into a few ounces of water only, in a bottle suitable for drenching. Very much water involves the possibilities of loss through spilling and the danger of getting the fluid down the windpipe. Do not mix with the feed. The medicine is apt to be rejected; and a cow really affected is not eating anyway. A most important thing is to get the sulfanilamide down, and at once, with no waiting and hesitating.

Also, if the new treatment is seemingly a wonderful success, do not let down in any way on any present proved sanitary precautions. Even with the sulfanilamide treatment, be sure to isolate any infected beast, and have her cared for and milked and handled by one not working with the remainder of the herd.

Professor Erf points out little has been accomplished to date in treating old and chronic cases where there is walled-off or scar-tissue in the udder, or where the attack is not streptococcic. But, to combat new and acute cases of streptococcic mastitis, the sulfanilamide is truly a godsend to the harassed dairyman. From continued work in the field we may find this nigh-uncheckable scourge in the past become in the future like a de-fanged rattler—terrifying, but comparatively harmless.

Alternate Bearing

Condensed from American Fruit Grower

A. Lee Schrader

Head, Department of Horticulture, University of Maryland

ALTERNATE bearing, also called biennial bearing, of fruit trees has worried fruit growers for generations, and formerly was responsible for the so-called "apple years" occurring every other year.

This alternate bearing with apples probably constitutes one of the earliest problems in crop production control and is regulated largely through the laws of nature. Many remedies and formulas have been advanced to change this bad "habit" of apple trees, so commonly enjoyed by several apple varieties including Baldwin, York Imperial, Wealthy, Yellow Transparent, and Yellow Newtown. Even many supposedly annual bearing varieties frequently have fallen into these evil ways, including Stayman, Grimes, Rome, Jonathan, Ben Davis, and even McIntosh which has been held up as a model for regularity.

What about the several panaceas to cure this habit? The accumulated knowledge in plant sciences in recent years has given us insight into nature's laws in this regard.

Pruning in the off-year, application of nitrogen fertilizer in the off-year or in the spring of the off-year, removal of blossoms by chemicals or by hand, thinning of the crop, effects of spring frosts, and irrigation have been studied in relation to tree growth and fruiting of biennial varieties.

Each part of these studies has led at one time or another to the belief that a single change in practice, such as pruning or fertilizing, would result in annual bearing of biennial bearing trees. Unfortunately, it has not been so simple a procedure. However, out of all of the studies, three general controlling principles have evolved which might be stated as follows:

1. As a tree grows, so it will fruit, or in other words, yield of fruit is related to amount of tree growth.

2. Blossoming and fruiting are exhaustive processes, utilizing food materials.

3. Blossom bud formation requires the same class of nutrients required for growth of tree and fruit.

In discussing principle number one, it might be recalled that the

Reprinted by permission from American Fruit Grower, 1370 Ontario St., Cleveland, Ohio, March, 1938

alternate bearing habit often has been considered as an inherited trait of a variety, fixed and immutable. Since annual bearing of so-called biennial varieties has been recorded, the habit cannot be considered as fixed in any variety.

It is realized that the length and diameter of terminal and spur growth, as well as type of leaf growth, are good indicators of what we may expect in fruitfulness of a tree. Both excessive growth and very poor growth conditions result in poor fruitfulness.

A happy medium of growth condition, usually described as vigorous, has been associated with maximum fruitfulness. As a consequence, every grower tries to maintain this vigorous condition and thus the greatest fruit bearing of his trees. Unfortunately, such a procedure may lead to excess cropping in any given year which would be one way of starting the alternate bearing habit.

Conversely, the elimination of a crop by winter freeze of fruit buds or spring frost in killing all blossoms, will start the same cycle of heavy crops alternating with light or no crops.

Varieties differ in the extent of response to such conditions, but *all varieties can be upset,* and changed from annual bearing to biennial bearing. This difference in tendency in varieties may be classed as variation of inherited character, or may simply be termed as variation in growth and reproductive responses to environmental conditions.

What can a grower do to prevent such undesirable responses? Considering tree growth alone, it may sound paradoxical to say that the maintenance of a vigorous growth condition by use of fertilizers, cover crops, mulching, irrigation, and other means is of prime importance, unless one sacrifices yields and is willing to accept small annual crops which usually accompany poor growth conditions.

Good, vigorous growth also means the development of large leaf area, which must be regarded as the main source of food materials for growth of tree, fruit, and formation of fruit buds. The question becomes one of distribution of these food materials in a socialistic manner so that all parts of the tree will be furnished with sufficient amounts.

A large crop of blossoms and the subsequent large set of fruit (some of which falls off) necessarily must require large quantities of food materials manufactured by the leaves. Many fruits fall off at June drop because of the heavy competition for food materials. Unfortunately, the formation of blossom buds for the next year's crop enters into this competition for food materials,

largely during the months of June and July.

With moderate blossoming and moderate set of fruit, distribution of food materials apparently is sufficient to take care of everything, including blossom buds for next year. With heavy blossoming and heavy set, the supply of food materials may be insufficient to take care of all the tree's activities, hence blossom bud formation does not occur, which results in no crop the following season.

If trees are blossoming moderately and fruiting moderately *annual cropping* results, which can be maintained usually by maintenance of growth conditions as previously stated. If trees blossom heavily and set a large crop, *alternate bearing* usually results.

A logical procedure would seem to be to thin off fruits to approximate moderate cropping whenever such a heavy set occurs. However, the solution is not so simple, as shown by the thinning experiments of this character.

Heavy blossoming and heavy set make a heavy drain on food materials, so that thinning to a moderate crop does not balance these conditions. More recent experiments show that a greater thinning of fruits, usually 80 per cent removal, is necessary to offset the blossom and fruit demands and permit distribution of food materials for formation of blossom buds. Such fruit removal must be done early (within 35 days after bloom) to be effective and trees must be in a vigorous condition with sufficient healthy leaf area per fruit.

Occasionally alternate bearing trees may have partial removal of blossoms by spring frost which, in effect, results in moderate blossoming. When such frost effects have occurred, moderate cropping was started and annual crops were produced in subsequent years. Similar thinning of blossoms, by hand, or by chemicals have not been found practicable as yet, but requires at least 75 per cent removal of blossoms.

On the other hand, annual bearing trees may form a heavy crop of blossom buds due to a frost effect on the present season's crop, or due to favorable weather conditions during June and July. Such trees are apt to start alternation in bearing unless heavy fruit thinning is resorted to.

Omission of nitrogen fertilizer until after blossoming of such trees also may help by decreasing set of fruit. Too heavy pruning of McIntosh in Wisconsin is considered by Roberts as responsible for increased set and alternate bearing of McIntosh in that State. In case of light blossom bud formation, every effort should be made to insure set by use of nitrogen fertilizers, bees, etc.

In a recent fruit growers' conference in Washington, D. C., Dr. E. C. Auchter, chief of the Bureau of Plant Industry, U.S.D.A., stated that new varieties which tend to be annual should be developed to replace our present bad offenders. If all varieties were annual producers, the apple crop would be more stable from year to year and market supplies more predictable.

With our present alternate bearing varieties, pending such removal in favor of other varieties, the method of heavy, early thinning might seem too expensive, both in labor and in partial loss of crop, but such thinning would be done only in the initial year, the cost of which should be made up the following year, especially if the following crop comes in a year of general light cropping for the country as a whole.

However, with the variety York Imperial, which is sold to a great extent to the export trade, the larger sized fruits borne with moderate cropping of annual Yorks did not find a ready market. The grower would be better off to have York trees strictly alternating, and, if possible, have half of his trees bearing one year and half the next year.

In addition to apple varieties, there are instances of alternate cropping of peaches, apricots, and other fruits. The same principles of correction apply to these fruits.

Alternate bearing of fruit trees can be changed to annual bearing by practical means at the disposal of the grower. Annual bearing can be maintained by the same means. Such orchard practices that will maintain a vigorous growth condition and healthy foliage is one requirement. Adjusting the set of fruit, if necessary, by early annual fruit thinning, or in case of heavy blossoming and heavy set, by heavy early fruit thinning, is another requirement. Special practices such as detailed pruning in removing weak wood, fall application of nitrogen, or withholding nitrogen in case of heavy bloom, mulching to conserve moisture, and irrigation—all contribute in adjusting conditions to meet requirements.

Tractor Care

Condensed from Kansas Farmer

C. N. Hinkle

IMPROPER adjustment and operation are the causes of most difficulties which result in tractor complaints.

A very common error often made by tractor operators is that of putting the tractor under load before it has had sufficient time to warm up. All tractors, regardless of make or fuel being used, should be started on gasoline and allowed to run at about half engine speed, with the radiator covered, until the water in the cooling system reaches proper operating temperature. The water in the radiator should be near the boiling point before turning on a heavy fuel, or the incoming fuel charge which has been vaporized in the intake manifold will condense when it strikes the cool cylinder wall and be scraped into the crankcase. This will wash carbon and soot into the crankcase and also dilute the oil. Many of the newer tractors are equipped with radiator shutters and temperature gauges for controlling the operating temperature of the cooling water. Such equipment will be a big help in eliminating the wide variations of temperatures often encountered on a cool windy day, when going with and against the wind.

Altho diluting the crankcase oil with unburned fuel is undesirable, it is doubtful whether it is as detrimental as we used to think. Several surveys conducted by professors and tractor builders show that there is virtually no difference in repair costs when tractors have been using a heavy fuel as compared to those which have been using gasoline. A study in Canada to determine the cause of excessive wear on tractors showed that a very rapid rate of wear took place during the warming up period. The engineers who were conducting this test stated that the rapid wear in their territory was due to lack of lubrication during the warming up period rather than to diluted oil.

Many farmers who own two-fuel tractors often ask the question of which fuel should be used in a tractor. The choice of fuel for tractors depends primarily upon the design of the tractor and on other factors such as operating loads, fuel prices, general economic conditions, convenience and tax exemptions. Economy is the principal reason for using a

Reprinted by permission from Kansas Farmer, 8th and Jackson Sts., Topeka, Kansas, Feb. 12, 1938

heavy fuel in the two-fuel tractor. Tests show that a two-fuel tractor on the same load will use about the same number of pounds of each fuel an hour. By using a heavier type fuel, the farmer will be able to buy his fuel at a lower price and as the heavy fuel weighs more, it will go farther to the gallon.

Fuel consumption tests conducted on three two-fuel, general purpose tractors, show that the fuel cost of plowing an acre of ground when using third grade gasoline was 21.8 cents an acre. The gasoline costs 12.2 cents a gallon. The cost of plowing an acre when using tractor fuel was 11.7 cents and the fuel cost 8 cents a gallon. By using tractor fuel in these two-fuel tractors, it was possible to save 10.1 cents an acre when plowing. A special attempt was made to burn each fuel most efficiently during the test. Whether this fuel saving is enough to offset such disadvantages as a special fuel for starting and less flexibility when using a heavy fuel, is a problem that the farmer will have to decide for himself.

For best performance a good grade, high octane tractor fuel should be used. A light straw colored fuel, usually indicates a "cracked" or higher octane fuel.

Whenever a heavy type fuel is being used, the heat adjustment on the manifold should be set in the hot position. Most tractors have these adjustments marked, but if there is any doubt as to the markings, move the manifold damper and listen to the sound of the exhaust. The setting which gives a muffled sound is the proper adjustment for burning the heavier fuels.

The results of more than 500 field tests, conducted during the past year, show that the average tractor carburetor is adjusted rich. No doubt this rich adjustment is the result of putting the tractor under load before it has been properly warmed up. This would require a rich carburetor adjustment to keep the tractor from stalling. It is not necessary or recommended that the operator keep tinkering with the carburetor, but it is advisable to adjust the carburetor for the various loads and fuels being used. To adjust the carburetor on a tractor, the tractor should be thoroughly warmed up and then put under load. The load or high speed adjustment should be screwed down until the tractor misses. This indicates that the mixture is too lean so that the needle valve should be opened until the tractor picks up the load and runs smoothly. The vibration in farm tractors often causes the float needle valve to wear in the seat. This allows the fuel to raise to a greater height in the carburetor bowl before it is shut off

by the float. Tractor complaints of smoking and uneven operation often can be corrected by adjusting the fuel level in the carburetor bowl.

Other common carburetor faults are excessive wearing of choker valves and throttle valve bearings. This allows dirty air to enter the intake manifold of the engine around the worn part without going thru the air cleaner. Many tractor operators fail to have these leaks fixed and their tractors will "inhale" enough dirt in a few weeks' operation to wear out the top piston rings, pistons, intake valve guides and often damage the bearings.

Many complaints of faulty lubrication and poor fuel can be traced to inefficient or neglected air cleaners. One of the principal reasons why many of the old tractors which were used in the dust areas of the West wore out so soon was that they were not equipped with efficient air cleaners. I know from my experience with an old tractor which I owned that what I once thought was faulty lubrication was nothing more than an excessive amount of dirt getting past an inefficient air cleaner.

In many cases where a tractor is being operated under extremely dusty conditions, much trouble can be avoided by extending the intake pipe to a greater height. Many of the older tractors were equipped with long intake pipes, but in operation these pipes were broken off and never replaced.

The oil bath type cleaner now is being used as standard equipment on virtually all the later model tractors. This cleaner requires less servicing than the oil soaked, fibre moss type and is very efficient if the proper grade of oil is used.

It is necessary to use a light oil in this type air cleaner or the incoming air will not atomize the oil and the dust particles will not be covered with an oil mist. The oil level should be kept at the proper height and in cold weather it is very important that an oil suitable for prevailing temperatures be used. A heavy oil sometimes causes a restriction in the intake and chokes the motor. It often is possible to correct many dilution complaints on motor oil by putting the proper grade of oil in the air cleaner.

In general, it is recommended that the oil be changed in this type air cleaner after about three-eighths to one-half inch of dirt has collected in the oil reservoir. By using new oil, the farmer will obtain the proper viscosity oil and there will be less chance of the oil thickening due to the air carrying off the diluent which might be present in a used oil.

A simple method of testing the efficiency of an air cleaner is to disconnect the air cleaner from

the carburetor and rub a white cloth on the inside of the intake. If any appreciable amount of dirt is present, it is an indication that the cleaner is not operating properly or the dirt is entering between the carburetor and the air cleaner.

A very important item in the life of the tractor is that of proper lubrication. The cost of good oil amounts to about 8 per cent of the total operating costs but if neglected, may result in repair costs many times this figure. Users of lubricating oils have no simple means of telling the quality of an oil. They must depend on a reliable company to supply a good product.

Failure of an oil to perform its duties of separating the wearing parts, sealing the pistons and carrying off the heat, will result in excessive friction, rapid wear, and loss of power. If the lubricating oil only partially performs its function, wear takes place gradually and it will take some time before the ill effects of faulty lubrication begin to show up. Thus the fact that the lubricating oil apparently is giving satisfaction is no guarantee that it is entirely satisfactory for use in the motor as the ill effects may show up at a later time.

The trend in tractor lubrication is toward the use of lighter oils. Improved lubrication systems, less clearances, better cooling, use of protective equipment, better fuels and better oils, all are responsible for this change. Lighter oils have the advantage of flowing more freely and will do a better job of protecting the engine during the warming up period.

A general rule to follow in selecting a motor oil is to use the lightest grade which will properly seal the pistons and separate the wearing parts. Experiments have proved that an oil which is too heavy will increase the fuel consumption, and the added cost of the fuel usually is more than the extra cost of using a lighter oil.

Of all the specifications relating to oils, the most important for the tractor operator to consider is that of viscosity number. Viscosity number is not an indication of quality but merely tells how heavy the oil is, or is the number which denotes the fluidity of the oil. The larger the number, the heavier the oil. The viscosity numbers range from 10-W to 60 or 70. The tractor instruction books and lubrication recommendations supplied by reputable oil companies designate the proper grade of oil to use.

In use, the crankcase oil becomes contaminated with particles of burned carbon, fine dust particles, and unburned fuel. The oil in the tractor motor should be changed at stated intervals, usually every 60 hours, but more of-

ten when operated under extremely heavy loads or dusty conditions. It is to be expected that a tractor motor when operating under good conditions, will use some oil. Therefore, it is advisable to check the oil level at least every half day, or oftener. A generally recommended practice for controlling dilution when using heavier fuels, is that of partially draining the crankcase at the end of every 10-hour period and refilling to the proper level with new oil. A higher viscosity oil often is used when a heavier fuel is used in the two-fuel tractor.

The filters which are commonly used on modern farm tractors are of the all-filter type; that is, all the oil is supposed to pass thru the filter before it goes to the bearings. The tractor owner, when buying a new tractor, often learns how all the oil passes thru the filter before it goes to the bearings, but sometimes fails to remember that the filter is equipped with a by-pass valve so that if the element is not cleaned regularly to prevent plugging, the by-pass valve will open and the bearings still will be supplied with sufficient lubrication. Farmers often become worried when they take the oil filter on their tractor apart and find a thick deposit on the filter element; they cannot understand how enough oil to provide proper lubrication can pass thru this dirty element. Such conditions often result in oil complaints which would not arise if the operator understood how the filter worked.

Most oil filters have a metal element which has a .003 inch spacing for filtering the oil. In service, these elements are very ineffective until they become coated with a thin deposit which acts as a binder and an additional filtering bed.

Laboratory tests conducted on used crankcase oils taken from tractors, show that where a deposit is found on the filter, the used crankcase oil usually contains very little fine dust particles, but where no deposit is found on the filter more dust particles will be found in used oil. In cases where heavy loads and dusty conditions are encountered, it is advisable to clean the oil filter every day.

About 1 gallon of water is formed and passed off in exhaust gases for every gallon of fuel burned. In cold weather, piston blow-by will allow some water vapor to enter the crankcase where it will be condensed. By cleaning the filter every day, the operator will prevent accumulation of much water which often results in sludge formation and clogging of oil lines.

Tractor transmissions also should receive some care and be properly lubricated. It is recommended that the oil be checked at

least once every week and be replenished if not up to the proper level. Most engineers recommend that the oil in the transmission be changed at least once a year. When tractors are operated only a few hours during cold weather, the proper viscosity of transmission oil can be obtained for this limited service by diluting the transmission oil with 10 per cent kerosene. It is very important that a light transmission oil be used in cold weather or the oil will channel and not be carried up to the bearings.

Whenever the transmission oil has been thinned for winter operation, it is important that it be drained and replaced with the proper grade of transmission oil before the heavy spring plowing season begins.

Front wheel bearings on farm tractors also should be given regular service. Most of the front wheel bearings are so constructed that dirt is carried out of the bearings by grease which works out around the inner dust seal. When lubricating such bearings it is important that enough grease be forced into the wheel so that a small amount works out around the inner side of the hub and carries out the dirt. The front wheel bearing should be carefully watched for end play and if any end play is noticed, the front wheel should be jacked up and the bearing adjusted. To adjust the front wheel bearings, tighten the lock nut until the wheel drags, then back off the lock nut about one-sixth of a turn. At least once a year the front wheel bearing should be removed and washed in gasoline or kerosene. Remove the old grease in the wheel and repack it with new grease. If the inner dust seal is removed it should be replaced with a new one. All dust seals on the front wheels should be inspected every time the wheel is removed and replaced if they show signs of wear.

Tractor owners who wish to operate their tractors efficiently should read their instruction book carefully, select a good motor oil, use a good fuel, service the tractor regularly, warm it up before putting it under load, and when using a heavy fuel the cooling water should be kept near the boiling point. Correct carburetor adjustment and running the motor hot will do much to prevent wear and increase the efficiency of burning the fuel.

Know Your Spinach

Condensed from Eastern States Cooperator

C. W. Clemmer

SPINACH is generally grown as a cool-weather crop, but by the use of the proper variety or cultural methods it can be grown all summer.

The common varieties are of two general types—the smooth-leaved and the savoy. In the smooth leaf group we have the *Viroflay,* one of the oldest varieties, and newer varieties such as *Hollandia, Amsterdam Giant,* and *Gaudry,* which are very similar in appearance. They differ somewhat in length of petiole, but on all of them the leaves are thin, light green, broad, smooth and pointed with more or less sharp corners at the base. They are not long-standing since they shoot to seed as the season advances to 14 or 15 hours of sunlight each day.

Nobel and *Matador* are somewhat similar, but stand somewhat longer and have blunted and shorter leaves. They will not produce seed stalks with less than 16 hours of daylight. Both are light green in color.

Viking, Northland, Giant Dark Green Smooth-Leaved. are the same general character as *Nobel,* but have dark green leaves. *King of Denmark* is a long petioled, very dark green, slow growing variety with small leaf blades. It is practically non-bolting under New England conditions. In other words, it requires more than 16 or 17 hours of daylight.

Darkie is a new variety with smooth, very thick leaves with a short petiole, and is slow growing. The leaves are from two to three times as thick as the usual varieties of spinach, are crisp and tender and cook up quite well. It is not an attractive spinach for the market, but from the home garden standpoint, it should be quite desirable. It stands as well as *Nobel.*

In the savoy type of spinach, we have what are commonly known as the Bloomsdale series. *Reselected Bloomsdale* is an improvement of a strain introduced by the David Landreth Seed Company some years ago. It is a quick-growing type with somewhat crumpled leaves growing erect off the ground, but bolts easily with about 14 hours of light. It is only useful in early spring, although in some places it is grown in the fall with fairly good results.

Reprinted by permission from Eastern States Cooperator, Springfield, Mass., March-April, 1938

Dark Green Bloomsdale and *Spinach No. 5* are slightly longer standing and darker green strains of the reselected type.

Long Standing Bloomsdale is a slower growing variety with well-crumpled leaves and erect habit of growth. There is considerable variation of season among different strains since seed stalks are formed from exposure to anywhere from 14 to 16 hours of daylight.

Summer Savoy is a variety or strain of long-standing type recently offered to the trade. Oftentimes strains of *Summer Savoy* are no better than a good strain of *Long Standing Bloomsdale*. A good strain of the latter planted in the same way as the recommendations for *Summer Savoy* will give just as good results. The apparent secret of growing summer spinach is to plant the seed at the rate of three to five pounds per acre. None of the *Summer Savoys* will hold more than 16 hours daylight, which is not as long standing as *King of Denmark*.

Presto or *Harlem Market* is a prickly-seeded, well-crumpled type. The seed is cold resistant so that it can be planted on snow or during the winter thaws in February or early March. The leaves are very dark green, and it is intermediate in type between the *Reselected* or *Dark Green Bloomsdale* and *Long Standing*, since it does not respond to less than 15 or 16 hours of daylight.

Aristocrat and *Spinach F* are of the *Long Standing Bloomsdale* type—dark green, and represent improvement on the old long standing variety.

Yellows is a disease commonly attacking spinach in the fall. It is carried by aphis. The Norfolk, Virginia, section is well adapted to the production of late fall spinach which this disease affects severely. Consequently, the Virginia Experiment Station has developed two varieties which are resistant to this disease and particularly suitable for the production of spinach during the fall season. *Virginia Savoy* is a well-crumpled, erect type of medium green color with blunt leaves. It bolts, however, on less than 12 hours of daylight and can only be planted as a fall crop to mature after the middle of September. *Old Dominion* is less well-crumpled, but similar in type with more pointed leaves than *Virginia Savoy*. It is slightly longer standing and will produce seed stalks on 13 to 14 hours of daylight.

For the successful production of spinach throughout the year, attention must be paid to planting the proper varieties at the proper time. The length of standing is the only character to consider since those who are using *Long Standing Bloomsdale* for fall planting are sacrificing 25 to

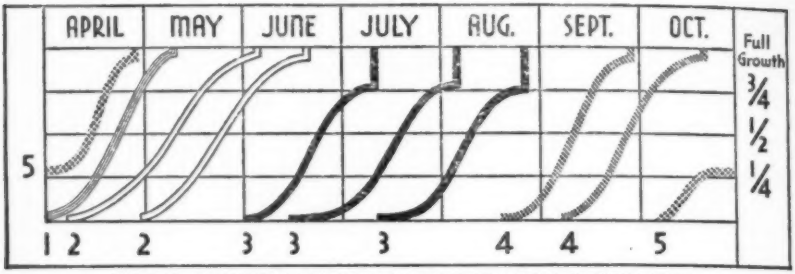
50 percent of their yield over what they would be getting if they had used *Virginia Savoy.Old Dominion* can be wintered over, but cannot be planted as a spring crop unless it can be harvested by the early part of April. *Presto* is a variety that fits into this particular overwintering program quite well, since it will stand somewhat longer than *Old Dominion* and is as cold resistant. The prickly-seeded characteristic is unfortunate, however, and is not popular with the growers.

Nearly all of the spinach seed is produced in Holland or Denmark. There are a few acres around Puget Sound in Washington state, and in the Riverhead region of Long Island, but the costs of production are too high to enable these to compete with the European crops. High temperature replaces the length of day somewhat in initiating the bolting response of spinach, but in general, the length of day reaction restricts the area of seed production to northern Europe, chiefly Holland. The reason for the large number of names of spinach varieties and the relatively few number of types is the copyright system that Holland has for variety names. There a seed company introducing a new variety copyrights the name and no other seed house can use that name, although it may eventually have the same strain in production.

The actual production of seeds is not complicated. The seed is planted in March in rows 18 inches apart, at the rate of 12 pounds per acre, and the plants grow until along in May or June before they start to bolt to seed.

We are told that the conditions for vegetative developments in Holland are so good during the spring that the plants reach enormous size, 18 to 20 inches in diameter being common. The mature plants are cut and stacked as we stack beans, the bases to the center and the seed towards the outside. They are cured in the fields for 10 to 15 days, then threshed and shipped to America early in September. It is very unlikely that any new seed from Holland can be brought to this country in time to make the early fall plantings, because even after it is threshed, a certain amount of after-curing or after-ripening is necessary in order for the seeds to germinate properly.

The average date of the first shipment is about August 15, and about 15 to 20 days are required to complete the movement to destination on the eastern seaboard.



THIS CHART SHOWS THE GROWTH HABITS OF THE FIVE SPINACH VARIETIES LISTED BELOW

1. *Dark Green (Reselected) Bloomsdale:* A first early spring seeding—rapid-growing, quick-bolting sort.

   Plant only as much as can be harvested within a few days.

2. *Long Standing Bloomsdale:* A slow-growing and slower-bolting type for early summer. Too slow for the first early spring or when used as a late fall crop.

3. *Summer Savoy:* A male free strain of slow-growing, late-bolting type of smaller growth. A light rate of seeding (five pounds per acre) affords more room for plants and retards seed bolting.

4. *Virginia (Blight Resistant) Savoy:* A quick-growing fall crop, resistant to spinach (yellows) blight; not adapted to early spring or summer growth on account of its quick bolting habits.

5. *Old Dominion:* A winter-hardy blight-resistant type for quick growth the following spring and is slower bolting than *Virginia Savoy*. Both bolt quickly if seeded in the spring or summer.

Note: All true spinach will bolt to seed as it approaches full growth and maturity, but some bolt quicker than others at different times of the year, as influenced by length of day and temperatures. All will bolt quicker on a thick stand than in a thin stand. Avoid crowding the plant, if long standing properties are desired.

Danish Dairying

Condensed from New Jersey Farm and Garden

E. J. Perry

DENMARK is small in size, being only twice as large as New Jersey, but it is great in its ideals and accomplishments. Of late years its success in marketing ninety per cent or more of its butter, bacon and eggs co-operatively has attracted the attention of economists everywhere. No less successful have been the efforts at efficient production.

In 1936 the average production per cow in Denmark was 7,150 pounds of milk and 275 pounds of fat. This is something of a contrast to our yearly yield per cow in this country which last year was about 4,200 pounds of milk and 168 pounds of fat.

In Denmark there are 204,000 farms, of which one-half contain twenty-five acres or less. Ninety per cent of the herds number less than sixteen milking cows. It is obvious that with so many small holdings the most intensive methods of management are necessary if even a very modest living is to be made.

One is surprised to learn that the soil is not naturally fertile. It has been built up with an almost religious zeal until today the average acre yields of the most common crops can be listed as follows: Wheat, forty-six bushels; barley, fifty-eight bushels; oats, seventy-five bushels; rye, twenty-eight bushels; potatoes, 237 bushels; mangels, twenty-seven tons; turnips, nineteen tons. Much experimental work has been done on manure utilization. On every farm liquid manure is stored in concrete tanks with no possibility of air circulation. Then it is pumped into a tank wagon behind which is attached a special machine which lets the liquid flow directly below the soil surface. This is a great saving because under the old system of sprinkling it on top of the ground the main part of the easily available nitrogen was lost by evaporation. All solid manure is packed tightly while stored in concrete pits and then when spread on the land it is plowed under immediately.

It was rather surprising to learn that forty per cent of the country is in cereals, and is therefore unlike Holland, another great dairy country, which is nearly all in grass. But Denmark

Reprinted by permission from New Jersey Farm and Garden, Sea Isle City, N. J., Feb., 1938

feeds many pigs and chickens which with the cows use grain to advantage. About sixteen per cent is in root crops, eight per cent is woodland and the remainder includes pasture, hayland and a few stretches of swamp and heather.

The three greatest means of cattle improvement have been the shows, the Kontrol Societies (Dairy Herd Improvement Associations) and the Breeding Societies (the Bull Associations). Probably another that should be mentioned is Selective Registration. The shows are tied up closely with the testing for production and the breeding programs. There must be commendable records of yield on the dams and grandams before bulls and heifers will be admitted to shows. Milking cows must also have records. Bulls are shown as individuals, but almost all the cows and heifers are in groups of three or four, representing the home herd. All animals must be more than a year of age. Only cattle that the owner has bred can be exhibited by him. The word "showmanship" does not seem to be in the Danish vocabulary because the only posing that is done at the fairs is to see that an animal stands squarely on its feet. The head is not being pushed up to make the back go down, and the belly is not tickled in order to make it go up. They are not paraded before the judges. The belief is that the cattle should appear before them and the spectators in a natural sort of way. Then they will look as good the day after the show as they did when judged. The type of the animal and not the ability of the showman is being appraised. Breed officials are sure that the shows have been a big factor in building better type and production. A comparison of the pictures of winners of fifty years ago and today attest to a revolutionary improvement in body conformation.

The great increases in butterfat test are another demonstration of what can be accomplished by breeding. In 1900 the average test of Red Danish, the breed which now includes more than sixty per cent of all cattle, was 3.3 per cent, and now it is 3.9.

Today there are 1,670 Danish Herd Improvement Associations with 53,000 members and forty-two per cent of the country's cows on test. Only one other country comes close to this high percentage and that is Germany where by a recent governmental decree all dairymen owning six or more cows are asked to join a Milk Recording Society. In Denmark as in this country the membership is purely voluntary.

The Breeding Societies have accomplished great things, too. The 1,240 of these, with twenty to thirty dairymen in most of them,

have a remarkable spread of influence. When young bulls are purchased they are usually secured from members of these cooperative breeding units. The price of the sires used in these ranges from $100 to $1,200 in our money. The rule that is generally followed in selecting a sire is to get one from a herd that is appreciably better than the one or ones in which he will be used. The newest and most successful Breeding Society to date anywhere in the world was studied by the writer. In it 1,200 cows were bred artificially last year. Only two sires were used.

Doubtless the quality of the breeding stock is safeguarded and improved by selective registration. The Federation of Agricultural Societies which publishes the Herd Books has ruled that no cows or bulls can be fully registered unless they are backed by commendable records of production. To qualify under the rules of the Red Danish breed, a bull must have a dam that produced a total of at least 882 pounds of fat in two consecutive years. To get into the Cow Herd Book a cow must, in addition to a record of 882 pounds of fat in two successive years, have an average of at least "200 kilograms of butter per year for the years of record." This means approximately 400 pounds of fat a year. The interest is apparently not in the number of registered cows but rather in those of proved ability.

In addition to these scientific approaches to economical production through such wide-scale milk testing, record keeping and scientific breeding practices, the other main reason for the good average production of 7,150 pounds of milk a cow are: (a) Better pastures, (b) the more careful feeding of cows as individuals according to daily yield, (c) more herds are milked three times daily, and (d) there are not the extremes in temperature which prevail in the United States. The cows are fed liberally with beets, hay and straw as roughage and with mixtures of linseed, cottonseed, palmnut, cocoanut, soy bean and sunflower oil cakes combined with ground barley, oats and rye. There is a shortage of hay. Ordinarily the cows get only a few pounds of hay daily and twice as much straw, but from 50 to 100 pounds of beets, depending upon the size of the animal. Of course, the beets are rich in carbohydrates and that is why oil cakes are given rather liberally. The protein content of certain strains of beets has been built up by years of selection and this has helped the feed situation appreciably. The three-times-a-day milking, when done there, is at 5 A.M., 11 A.M. and 5 P.M., and results in an average increase of nine per cent only, because it is not

done eight hours apart as in this country, where the increase is fourteen to twenty per cent.

Certain nations can exchange experiences to advantage. Some of the methods used in Denmark would not be practical under our conditions, and vice versa. It is very obvious, however, that a number of the intensive and constructive dairy practices will find increasing favor among the larger countries.

What Should I Have in My Lease?

Condensed from The Ohio Farmer

J. I. Falconer

METHODS of renting land are of general interest. One of the essentials of any lease which is to prove satisfactory is a fair division of the returns. The landlord whose farm is worth $125 per acre contributes more when he contributes his farm than does the landlord whose farm is worth $40 per acre. The tenant who operates a tobacco and dairy farm probably contributes more in the way of labor than does the tenant on a corn, wheat, and hay farm of the same area. The amount received by either party to a lease should be in proportion to that which he puts in. Farm leases to be equitable should be built upon this principle. There is no one farm lease which will fit all farms.

A second essential of any good lease is that provision be made for maintaining the productivity of the soil. Study and observation will generally show that the crop yields on farms operated by tenants average a little lower than those upon farms operated by their owner. There may be several reasons for this, but it is not always because the tenant does not appreciate the importance of good crop yields in profitable farming. It is more often due to the fact that the tenant has no assurance that he will be able to reap the benefits of any time or expenses which he puts into the maintenance or improvement of the productivity of the farm.

A third essential of a good lease is that provision be made for adequate capital with which to carry out the terms of the lease. It is folly to include in the lease provision calling for the expenditure of more money than is available either on the part of the landowner or the tenant.

There are three common meth-

Reprinted by permission from the Ohio Farmer, 1011 Rockwell Ave, Cleveland, Ohio, Feb. 26, 1938

ods of renting land in Ohio, namely, cash rent, crop share rent, and livestock share rent. About 25 percent of Ohio rented farms are rented on a cash rent basis, while the remainder is divided about equally between the crop share and the livestock share lease systems. Under the cash rent system the tenant pays a cash rent for the farm. Under the crop share rental system he pays as rent a certain portion, usually one-half of the crops. Under the livestock share system he pays as rent a stipulated portion, usually one-half of both the crop and livestock income.

Probably three-fourths of Ohio leases are made on a one-year basis. Many feel that a longer lease is preferable. It is probable, however, that the one-year lease with a provision for renewal is as satisfactory as any. Studies have shown that those renting farms from year to year actually stay on the farm longer than those who rent for a term of years. There is little merit in continuing a rental agreement if the arrangement is not satisfactory to both parties. The one-year lease should provide that either party should notify the other, if he does not wish to continue the lease, six months before termination.

Most Ohio leases begin as of March 1. This is before the spring work begins, and when the supply of feed, which would have to be moved, is at about its lowest.

It is usually customary to include in the lease some provisions regarding the use of the land. The land to be retained in pasture or grass and not plowed should be designated. The crops to be grown should be named. Many leases name the approximate acreage of each crop. This is especially true of special crops such as tobacco. There is usually a provision regarding the use of fall pasture. With the share rental system the number of cows, cattle and horses to be kept are frequently designated in the lease. This is especially true in the case of the crop share lease. There should be no unnecessary restrictions in the lease which will interfere with the adjustment of the system of farming to the farm and market conditions.

The custom is for the landlord to furnish the material for fence repairs, while the tenant does the work. Some landlords pay the tenant a wage for time spent in building new fences if done at the request of the landowner.

The lease should make provisions for maintaining the productivity of the soil. Among the provisions commonly found in Ohio leases to this end are: Those providing for the inclusion of a legume such as clover, alfalfa or sweet clover in the rotation; the provision that none of the crops shall be sold from the farm ex-

cept wheat without the landowner's consent; that none of the straw, stover, or hay shall be sold or carried off the farm. To insure the sowing of clover many share leases provide that the landowner shall furnish all the clover and grass seed. Many landowners who rent on a cash basis have the same provision in their lease. When lime is applied it is customary for the landlord to buy the lime, the tenant to haul and apply. In some cases where the haul is long or the application heavy the landowner agrees to pay part of the cost of hauling and applying, should the tenant leave before two crops are harvested. The lease should contain a clause to the effect that the manure will be hauled regularly from the barn and yard to the field and that no manure made from feeds produced upon the farm shall be sold or removed from the farm.

All leases should contain articles providing for the destruction of weeds. Such a provision frequently states that the tenant shall mow all fence rows between July 15 and August 15. In the case of a weed plague such as Canadian thistles the lease usually provides for the co-operation of the owner with the tenant in their destruction.

Share leases frequently stipulate that no work shall be done by the tenant or his teams off the farm without the consent of the landowner.

The lease should state clearly and definitely what each party is to contribute and what is to be the division of the product. Provision should be made for the necessary working capital and the necessary labor to successfully operate the farm.

It is the custom in Ohio that the year-to-year tenant has a right to return and harvest the wheat crop sown the previous year. Many leases, however, dispose of this matter otherwise. Many landowners reserve the right to purchase the outgoing tenant's interest in the wheat crop if they desire to do so.

Some leases contain a clause providing for arbitration. A common provision is that in case of failure to agree the landowner shall appoint one man, the tenant another and they a third. The decision of these three to be final.

Forest Genetics

Condensed from American Forests

Lloyd Austin

THE widespread interest in conservation and reforestation throughout the nation today is focusing attention more and more upon the need for improved strains of forest trees. People are awakening to the realization that the commonly-used forms of even the best species of existing timber trees are, in most instances, comparatively ill-adapted to planting under present economic conditions.

Is it not too much to expect that the wild types of trees as found in nature would be ideally adapted to meet the exacting demands of the present day? Centuries ago the agriculturists realized the inadequacy of wild plants and animals and began their efforts to develop superior strains. Today, after an extended period of breeding and selection, there are available for the use of modern farmers a great many improved types of farm crops, orchard fruits and domestic animals. Most of the original wild types have long ago been abandoned for economic production.

It is little short of amazing then, that at this same period of development almost all reforestation activities are seriously encumbered, and rendered only partially effective, by the fact that they must, of necessity, utilize the wild, primeval types of forest trees that have not been improved from those that were available when white man first trod upon American soil.

Why such a paradoxical situation? There are probably two fundamental causes. In the first place, so long as there was an abundance of virgin timber, forestry was, to a considerable extent, merely a matter of protecting, harvesting and marketing nature's accumulation of centuries. But now that man must take an active part in restocking the vast areas of denuded land, timber must be regarded as a crop, and as such falls naturally and properly within the domain of the plant breeder or geneticist. Secondly, it seems likely that the great longevity of timber trees, and the infinite complexity of the problem, have, until recently, deterred foresters and geneticists from giving detailed thought to the possibilities of specializing in this particular field of research.

In 1924 there was no institu-

Reprinted by permission from American Forests, 919 17th St., Washington, D. C.

tion in the United States, and probably none in the entire world, devoted solely to the production of inherently superior rapid-growing strains of forest trees. But in 1925 through the vision and foresight of James G. Eddy, a lumberman of Medina, Washington, the Institute of Forest Genetics was founded at Placerville, California. Mr. Eddy's knowledge of the practical aspects of forestry and his studies of plant-breeding achievements led him to the conviction that the improvement of the wild strains of timber trees is both necessary and feasible—a conviction that has since been abundantly confirmed.

Many have thought that the genetical principles of selection and hybridization could be applied to forest trees, but no other American took steps to actually establish an institution devoted solely to that purpose.

As the research in this virgin field has progressed, and as its aims and purpose have gradually broadened to meet the needs of the nation, there has been a natural and corresponding broadening of the organization of the Institute of Forest Genetics.

Placerville, California, was chosen as the site for the Institute's main experimental station because of an unusual combination of favorable conditions. It lies in the center of the belt containing the finest stands of the principal western pine, ponderosa pine. Within the confines of the State of California can be found more species of pines, on which the Institute is specializing, than grow wild in any area of similar size in the world.

Climatic conditions are naturally of fundamental importance in determining a suitable location for an enterprise of this character. The average growing season at the Institute is 237 days.

Although the climate at the main experimental station itself is quite moderate, there is abundant opportunity within a driving distance of fifty miles, to obtain testing areas in the foothills and higher reaches of the Sierra where minimum temperatures range from sixteen degrees above zero to thirty degrees below. On the Atlantic Seaboard one would have to travel about a thousand miles, from central Florida to New England, to find an equal range in minimum temperatures.

During the ten years since its founding the Institute has uncovered many encouraging facts that indicate clearly that forest genetics is not only entirely feasible, but that it will yield usable results in a much shorter time than had been anticipated. Some of the very factors that are ordinarily regarded as serious obstacles to progress have been overcome and have been turned about so that

they now serve as material aids to the tree breeder. For example, the long life of timber trees was regarded by many as a factor that made it seem likely that it would be at least several decades before tree breeders could offer to forest planters seeds of improved new types in sufficient quantities to be of practical significance in reforestation. Yet a short-cut method has been devised that makes it possible in a relatively few years to isolate from among the innumerable strains of a given species that nature has produced through countless generations, those with superior germ plasm—that is, those that have the inherent characteristics most desired by present-day planters.

The process used is known as a "Progeny Test" and it isolates these superior, vigorous strains as individual seed-trees in the forest, based on well-replicated nursery and plantation tests of their progenies. The very fact that timber trees are longer lived than agricultural crops is a distinct advantage, for it makes possible a long-continued supply of better seeds once the desirable seed-trees are found. Many of these superior trees that are being discovered as the investigations progress have been growing for a hundred years or more, and are capable of yielding for many decades heavy seed crops every few years. Even a single seed crop from one of these selected seed trees will often be such that enough seed can be collected to produce from 5,000 to 20,000 superior seedlings. This illustrates the untold potentialties of these new genetical methods, and the comparatively short time required for them to yield results that have practical application to present-day reforestation.

Results so far seem to indicate that the easily obtained wind-pollinated seed is usually adequate for the various preliminary tests in which seed is gathered over wide areas, even though only one parent is thus known and controlled. However, as the investigations become localized in the areas that are found to contain the better trees, it may prove desirable to conduct some of the progeny tests with self-pollinated seed. Also, various tests of crossing the better individuals will be helpful in showing which combinations of parents will yield the best offspring.

The application of this progeny test method over a wide range of seed sources has not only pointed out some of the best individual seed-trees in each locality, but it has also brought to light marked differences in the general character of the numerous local strains. In one such test with ponderosa pine the Institute compared side by side in a single nursery the

progenies of 765 individual seed-trees growing in sixty counties in twelve western states and in British Columbia. The data gathered from this exhaustive study revealed the existence of numerous geographical races of this important timber species, each with distinct physical characteristics that will affect both the volume and quality of the lumber produced. One of the most significant and useful of the facts that these tests have revealed is that, in the Sierra Nevada of California, hereditary vigor has been found to be quite generally associated with the lower elevation of the seed source.

There probably will be no one best strain of any one species of pine for all timber-growing climates and soils where the species is to be used. Various superior strains will be needed, and as these are gradually developed and widely tested, they can be expected to exhibit some variation in the expression of their hereditary characters in different localities, depending on the local environmental conditions.

From still another line of experimentation has come valuable new information that demonstrates the practicability of improving the strains of forest trees within a reasonable length of time. Many had thought that it would usually be necessary to wait until seedlings were fifteen to twenty years old or more before they would flower so that hybridization experiments could be conducted with artificially-grown trees. But tests in the Institute's nursery and arboretum have shown that many different species of conifers, particularly pines, flower at the early ages of two to five years.

As early as 1932 no less than forty-four species of forest trees were flowering in the Institute's arboretum, although the first plantings were made only six years before, and many of the trees were considerably younger than this.

Another discovery offering much encouragement to the pine breeder is the great longevity of pine pollen. Simple and inexpensive methods have been found that will often keep this pollen viable for a year or more. This is in sharp contrast to the condition that exists in some other plants, such as corn, in which the pollen lives only about twenty-four hours, and if not used within that time is of no avail. The long life of pine pollen makes possible its shipment from the forests of distant countries for hybridization with native species and with others that may be flowering in the arboretum.

The possibility of hybridizing forest trees, and of actually combining in a single new hybrid form the desirable characters previously existing only in separate

species, has been fully demonstrated in hybrids produced at the Institute, as well as in certain natural hybrids that have been discovered. The most outstanding of the Institute's artificial hybrids to date is a cross of the Knobcone pine, *Pinus attenuata,* a relatively slow-growing but hardy species, and the Monterey pine, *Pinus radiata,* a species which lacks hardiness but which is the fastest-growing of all species tested from forty countries. All of the hybrids have, very fortunately, inherited the cold-hardiness of the seed-parent and the rapid growth of the pollen-parent.

As one of the results of the study of artificially controlled pollination of pines it has been observed in experiments with several different species that when the flowers of a pine tree are pollinated with pollen from the same tree, the yield of seed tends to be abnormally low, and the germination of the seeds is usually comparatively poor. In addition, the resultant seedlings are often quite deficient in vigor, as compared with normal seedlings resulting from wind-pollination, which ordinarily seems to include much crossing with neighboring trees. These results may be taken as indications that, in all probability, many of the individual trees in the wilds are partially self-sterile and will yield vigorous offspring only when cross pollinated with pollen from other trees, usually of the same species.

Apparently pines behave much as do many of the crop plants, such as corn, that have been under tests by geneticists for decades. It is a common experience in plant breeding to find that there is a reduction in vigor following selfing or inbreeding, particularly in the first generation. One application of this finding in practical forestry is to avoid the collection of seeds from individual trees that are comparatively isolated, since such seeds are probably mostly self-pollinated. Also, in choosing seed-trees to be saved in logging operations the desirable practice, judging from present knowledge, would seem to be to leave them in small groups; or if left singly, the seed trees should be left close enough together to insure adequate cross pollination by the wind.

It is well recognized that hybrids between species often will not come true when reproduced by seed. Consequently the Institute has given some attention to the possibility of reproducing pines by budding and grafting, which are the usual commercial methods of propagating practically all orchard fruits and many ornamentals, in order to insure trueness to type. Though these methods of reproducing pines are still in the experimental stage, the preliminary tests of budding

and grafting were quite successful, even when one species was budded onto another.

The more one studies genetics, the more thoroughly he becomes convinced of the widespread application of the fundamental laws of heredity.

It is because forest genetics has often been regarded as an exceedingly slow and unpromising line of scientific endeavor that I have purposely summarized in this article some of the Institute's results that point strongly in the opposite direction. If we may be permitted to judge the future by the accomplishments of the past, the prospects from our present vantage point seem very bright for bringing about, through the use of genetics, some major advancements in American forestry.

Barley's Future

Condensed from Successful Farming

Harry V. Harlan

SOME of us who are watching the race of today's crops towards greater economic importance may be startled to find barley right up in front—not in total acreage but in *increased* acreage.

Since 1866 corn acreage has increased threefold. The oat crop of 1935 was approximately five times that of 1866. But the barley crop was 13 times greater! Moreover, the increase in barley has persisted longer. The corn acreage more or less stabilized about 1909. The oat acreage became relatively constant by 1916. The increase in barley continued until 1928. The period since that date is too short to be certain that stabilization has occurred.

Factors in increased barley acreage are several: Barley returns high yields of feed in the northern and western states. Again, barley fits well into many rotations; it makes a rapid early growth and smothers many weeds by its development of heavy foliage. It usually matures before the advent of high summer temperatures and therefore occasionally produces good crops in years when later-maturing plants are seriously injured. Finally, the malting market is back, and, while only a small percentage of the normal crop will go to the maltsters, the premiums on malting barley may have an effect on the total planted.

What kind of barley should

Reprinted by permission from Successful Farming, Des Moines, Iowa, April, 1937

the farmer grow? The question is very involved. In two cases only is it clear. Those farmers growing barley for the malting market should seed varieties for which the maltster will pay a premium. In the upper Mississippi Valley, maltsters prefer six-rowed varieties with small kernels. Preferences are now expressed for Oderbrucker, Manchuria, Velvet, and Wisconsin Pedigree 38—about in the order named. The farmer, however, must compute his cash return per acre, and it does not follow that he should grow Oderbrucker unless the premium for Oderbrucker is sufficiently great to offset the higher yield of Wisconsin Pedigree 38, for instance. The fact that Oderbrucker and Manchuria are decreasing in acreage indicates that many farmers do not find these varieties so profitable as others.

Part of this decrease may be due to the choice of a second class of growers—those who grow barley for feed. In their case the crop never leaves the farm where it is grown. Such farmers are interested in pounds of feed per acre. Where the highest-yielding variety is known, they have little reason for growing any other.

The farmer who has the real problem is the one who expects to give the crop little special care, who usually feeds the grain, but who, in the years when his locality is especially favored by season, hopes to catch an occasional premium. If he grows a malting variety, he may, in some areas, sacrifice yield. If he grows something else, he mixes a different sort in the local elevator and injures his neighbor. In any case he adds to the difficulties of those farmers who devote their entire attention to the malting market—yet he is in business to make money.

But to return to the story of barley's future, individual farmers can supplement the work of experiment stations in determining the *direction* of the advance. The testing fields of experiment stations are limited in number. They can approximately determine the relative producing value of a new variety; they can give a general idea of the area to which it is adapted; but this may or may not apply to an individual farm.

To those farmers who wish to be sure that they are planting barley best suited to their individual conditions the following variety-comparison procedure will be helpful: A part of the field known to be uniform in soil should be used. It is handy to use two drill widths to a variety, as this permits one round trip of the drill for each seeding. Space should be left between the general field and the varieties being tested, and also between the varieties—most easily accomplished by guiding

the drill wheel on the last wheel track instead of on the last row seeded. This leaves the space of one drill row unseeded, which affords sufficient room to cut the plots separately by careful driving. If the two or more varieties are repeated five times each, the results are more dependable than if they are seeded only once. Several years' results are necessary, since varieties of nearly equal yielding capacity fluctuate in their relationship according to season. Unless tests are conducted in such a way as to make a true comparison, they are not useful. Indeed, they are often misleading.

The field of breeding is also open to the farmer, though it requires more work and care. Barley breeding trains the eye and stimulates judgment, gives another interest in life, and leads to new contacts of a different sort.

There is work enough for many, many barley-breeders. We are only at the beginning. When we observe that 80 per cent of the barleys grown in the United States are the product of plant breeding, it looks as though we had covered the field. But, although these new sorts are superior to the ones they displace, there is not a single variety grown which does not have well-known defects.

In many cases we know varieties that possess qualities that would improve the ones now grown if we could succeed in combining the valuable feature of two or more strains. It requires years of work to do this, and often when the process is half completed, we discover a new form that we feel would have been much better to use than the one already in the program.

Some problems, such as that of winter barley, are not even understood. Why is winter barley less hardy than winter wheat? Is it possible to make it the equal of wheat or is there some inner process of barley that makes it more sensitive and will always limit its endurance to cold? No one knows. I have seen winter barley freeze out in a mild winter and I have seen a fall-seeded spring barley withstand 30° below zero with no snow cover.

The barley varieties commercially grown are not necessarily the ones to use in breeding work. It is true that most of the new, smooth-awned sorts probably contain many variations that could be detected, selected, and tested by an observant farmer. When two barleys are crossed, in succeeding generations the plant characters become slowly "fixed." That is, each plant eventually produces plants that are like its parent with reference to a specific character. Before a variety is released, it is supposed to be fixed. However, all differences are not expressed in a way which can be

observed. Even in observable characters, the breeder may be mistaken and variations may still occur. As a consequence, a field of hybrid origin may contain plants similar in their appearance and market usefulness, but differing slightly in their capacity to yield, in the smoothness of their awns, or in the tightness of their hulls.

Many varieties of cereals have resulted from single plants isolated by farmers. The chances of success are much greater where a considerable number of desirable plants are chosen and the seed sown in separate rows.

If the farmer wants to start at the beginning, he should secure material from a state experiment station or from the Government. He could make hybrids himself or might secure material at some stage after crossing. The simplest method is to grow the crossed seed for a few generations as a mixture. Then some year he should space-plant his seed and select plants that appeal to him as being good. These are then to be tested in short rows and the low-yielding and otherwise objectionable sorts discarded. Each year he could weed out the poorer ones until he finally determined his best strains. By that time, usually five to eight years, he would probably have contacts enabling him to secure a wider test. If he were working with winter barley, survival notes would be necessary as well as yield data.

No one can guess whom fortune may favor. Something may come quickly or success may be slow or even lacking. There may be hard work, but there is the same thrill of the unknown that urges the prospector on and on—and in any case, it's a pleasant road.

Outbreeding Best for Average Production

Condensed from American Hampshire Herdsman

PROGRESS in the project to compare the relative merits of limited inbreeding in swine was reported by O. S. Willham at the annual feeders' day at Oklahoma A. & M. College. This project was started in 1923 by W. A. Craft who, since 1936, has been in charge of swine investigations for the Bureau of Animal Industry, U. S. Department of Agriculture. The sixth, seventh and eighth generations of inbred pigs are now under observation at the Oklahoma Experiment Station.

Mr. Willham presented the following summary of the project up to the present time:

1. Seventy-five outbred and 117 inbred litters have been farrowed to date. The outbred litters have averaged 9.29 pigs and the inbred litters have averaged 6.64 pigs. This difference is significant.

2. Still-born pigs were farrowed in 49.33 per cent of the outbred litters and 36.75 per cent of the inbred litters. There were more still-born pigs in the inbred litters. Of the total inbreds farrowed 12.36 per cent were still-born, while only 9.61 per cent of the outbreds were still-born.

3. The birth weight of the inbred pigs was 2.08 pounds as compared with 2.41 pounds in the outbred pigs. If only live-born pigs are considered in each group, the inbreds averaged 2.13 pounds and the outbreds averaged 2.47 pounds at birth. These differences are significant.

4. From time to time representative pigs were selected from each group and fed individually for a 30-day period. Records are available for 31 outbred and 29 inbred pigs. The outbred pigs have required, on the average, 420 pounds of feed to put on 100 pounds of gain and the inbreds have required 438 pounds of feed for 100 pounds of gain. Paired digestion trials were run with 39 inbred and 30 outbred pigs. It was found that the outbred pigs had higher coefficients of digestion for protein and nitrogen-free-extract than did the inbred pigs. The feed records for the pigs from weaning to 225 pounds indicate that the outbred pigs are more efficient in feed utilization. The latter records have not been completely summarized.

5. In the inbred group, 54.04 per cent of the live-born pigs lived until weaning and averaged 24.02 pounds at that time. In the outbred group 63.49 per cent of

Reprinted by permission from American Hampshire Herdsman, 915 Commercial Bank Bldg., Peoria, Illinois, Aug., 1937

the live-born pigs were weaned and they averaged 26.68 pounds at that time.

6. The inbred pigs averaged 39 days older than the outbred pigs when they reached 225 pounds in weight. The losses from weaning to 225 pounds were more in the inbred group.

Necrotic enteritis has been responsible for the heavy losses in both of the groups of pigs. The outbred pigs have seemed to be more resistant to the attacks of necrotic enteritis and also to round worms.

The observations made in this project so far indicate that outbreeding is a more profitable system of breeding than inbreeding, especially in commercial production. These results agree well with the results found with other kinds of animals. There seems to be little question but that outbreeding is the system that should be used by the man who is interested only in raising animals for the market.

Limited inbreeding has been carried on successfully in this project. Inbreeding was used extensively in the formation of most of the pure breeds of livestock. It is a very useful system for fixing type and making breeding animals prepotent. One of the breeder's large problems is to find out just how fast he can inbreed and still, by means of rigid selection, keep from fixing some of the undesirable characters for low fertility and a lack of vigor. It is the problem of the livestock breeder to furnish the livestock producer with superior animals to use for commercial production.

These Frozen Eggs

Condensed from Everybodys Poultry Magazine

Roland C. Hartman

PACKED in cans piled row upon row, there stood in cold storage plants throughout the United States on January 1, 1938, an estimated total of 108,036,000 pounds of frozen eggs. Translated into cases of eggs, it represents the equivalent of 3,087,000 cases—nearly four times the number of cases of shell eggs in storage on that same date.

The fact of the matter is, frozen eggs in storage on January 1, 1938, were at their all time peak.

Most poultry raisers are unaware of the marked growth of the frozen egg business. As an industry, it is comparatively young.

Reprinted by permission from Everybody's Poultry Magizine, Hanover, Pa., March, 1938

The government made its first report of holdings of frozen eggs in storage in 1917.

The growth of the business of breaking out eggs and freezing them was gradual. By January 1, 1928, the holdings of frozen eggs totaled 47,020,000 pounds. Aided partly by tariff increases on frozen eggs in 1929 and 1930, breaking operations jumped in 1930 and have continued at a relatively high level.

Probably the main reason for the growth of this business is the fact that liquid or frozen eggs offer certain decided advantages to those food industries which use large quantities of eggs. Once a food industry switches to the use of liquid or frozen eggs, it is not likely to return to the practice of buying eggs and breaking them out as they are used. Why go to all that bother and fuss when quality eggs can be purchased in liquid or frozen form ready to use?

Even the small bake shops now use frozen eggs as a matter of convenience. One large food distributing organization provides daily deliveries of frozen eggs to bakeries.

Then, too, while the price of liquid or frozen eggs is not constant, there is not the pronounced fluctuation in price which occurs in shell eggs. Within certain limits, the baker, candy or mayonnaise manufacturer can estimate what the cost of his eggs will be.

The great bulk of frozen eggs is used in baking products. The Agricultural Adjustment Administration in 1935 made a survey of the egg breaking industry and estimated that more than 50 per cent of the frozen eggs were used in bakery products. Between 1 and 5 per cent were used for salad dressing; a similar amount in noodles or macaroni, and also in ice cream and frozen custards. Less than 1 per cent was used for food beverages, and sausage manufacturing also used under 1 per cent.

The bakery industry uses large quantities of mixed eggs, that is, both whites and yolks broken out and churned. It also uses whites and yolks separately. Mayonnaise, salad dressing, macaroni and ice cream manufacturers use mostly yolks. The candy and confectionery business, on the other hand, uses whites or albumen, but no mixed eggs or yolks. Since yolks are being used at a more rapid rate than whites, there has arisen the problem of disposing of the albumen which cannot be absorbed. Studies have been made in an attempt to find new industrial uses for egg albumen.

There was a time when most of the egg breaking plants were located in or around the large cities. In those days, they broke out eggs that were largely in the lower grades. They could be con-

sidered as being on the borderline, still edible, but not likely to reach the buyer in such good condition.

This picture has changed. The manufacturer of food products is particular about the eggs he uses, because flavor is the important thing in the finished product. He may go so far as to specify that the eggs contain a certain percentage of solids, or that they possess certain whipping qualities. Quality has become so important, that some egg breaking plants paid premiums last year to obtain the better grade eggs.

Today the egg breaking plants are located in the producing sections, principally in the Midwest where farm flocks are numerous and eggs can be purchased during the season of flush production at relatively low prices.

The breaking of eggs is largely a seasonal business. Most of the breaking operations are conducted from March through July. Activities in these plants taper off sharply from August on, reaching the low point along about November and December.

In a modern egg breaking establishment, every precaution is taken to see that only good eggs are frozen. Even before the eggs reach the breakers, they are candled. Because so much depends upon the judgment of the girl who is breaking eggs, she has to be carefuly trained and then supervised closely, so that she can distinguish the undesirable eggs from those that are good. Each egg is broken out into an individual cup before being transferred to a larger container.

Since the work of breaking out eggs is so exacting, the women who are employed in these plants are given rest periods of 10 to 15 minutes every two hours. Because of the seasonal nature of the business, the breaking plants try as far as possible to employ the same women year after year.

What is the effect of frozen eggs on fresh egg prices?

In the eyes of the producer of fresh, nearby eggs, it may appear as though frozen eggs compete directly with his product. This may be true in a sense, but not with respect to household use. There has been a pronounced decline in home baking, and more housewives are buying their cakes from the store. It is not likely either that bakeries would want the nearby eggs if they were using shell eggs, because the price would be considerably above that of Midwestern eggs during most of the season.

Like the storing of eggs in the shell, the breaking and freezing operations help to remove eggs from the market at the period of flush production to be held for use later when supplies are curtailed.

While these plants have a stabilizing effect on egg prices to

quite a degree, the extent of their activities can also have a weakening effect. For example, if the holdings are heavy and the plants decide to decrease their output or postpone their breaking operations, it means that more eggs are being marketed in the shell. It is very much the same situation which occurs when hatcheries cut down on their settings because of lack of demand for chicks. Those eggs that would otherwise be incubated go on the fresh egg market at a time when supplies are plentiful anyway.

Not so long ago, operators of the egg breaking plants got together in Chicago to consider their problem of heavy holdings. A marketing agreement under the Agricultural Adjustment Act was discussed as a means of limiting the output of frozen eggs, but no action was taken. It is possible that the industry may undertake some co-operative method of solving its problem.

Because frozen eggs do have an influence on the general poultry situation, the poultry raiser who has been in the habit of following the cold storage holdings of shell eggs must now give some consideration to the holdings of frozen eggs.

$100,000,000 Booms the Piney Woods

Condensed from Southern Agriculturalist

Wyman Smith

IN 11 Southern states $100,000,000 are going into pulp and paper mills that will turn pine trees into kraft paper, paper containers, boxes and packages. One mill is even experimenting with the manufacture of newsprint so that there is a possibility that the pines may find a still greater market.

The Forest Service of the U. S. Department of Agriculture recently made a survey of 42 million acres of land extending from North Carolina along the Atlantic and Gulf coasts to Texas and inland approximately 125 to 150 miles. The survey shows that pine trees are now growing in the area at the rate of about 8 million cords a year while they are being used at the rate of 7 million cords a year.

But the hundred million dollars of new pulp mills which will be completed in about a year will consume nearly two million additional cords of wood annually.

Reprinted by permission from Southern Agriculturist, Nashville, Tenn., Feb., 1938

Pulpwood mills that are members of the American Pulpwood Association have worked out a program they hope will help to conserve the treasures of the piney woods.

State and extension foresters are also rallying to the aid of the pines, and the U. S. Forest Service estimates that pine owners can increase the growth of their pines to take care of the demand if they will manage the piney woods properly and protect them from fire.

"The woodland crop can be harvested at five to ten-year intervals for generations to come under proper management," says the Forest Service. "Second growth pine is making an average growth of one-quarter to one-third of a cord of wood per acre per year at present, but under good forest practices the average yield of wood can be increased to one cord per acre per year."

The temptation to take an immediate profit is great, but cutting the small sticks is what endangers the long-time prosperity of the piney woods. While farmers are able to sell almost any kind of a tree that will make a pulpwood stick four inches in diameter at the small end, the foresters report that such young tree are capable of making rapid growth if left standing.

Curiously enough the small trees do not return a great deal for the labor used in making pulpwood sticks out of them. Time studies made by the Forest Service show that it takes nearly twice as long to cut a cord of wood from 6-inch trees as it does from 12-inch trees. Then, too, cutting a cord of wood from 5-inch trees takes six times as many trees as it does from 9-inch trees.

Of course, some young trees can be cut when it is necessary to thin out stands, but when such thinning operations are made, the U. S. Forest Service recommends leaving 200 of the thriftiest, best crowned trees on each acre to produce future crops. Trees interfering with the growth of selected trees should be cut because a stand of timber needs to be weeded just the same as a cotton patch. The best timber can be held until it is fit for poles and sawlogs. From two to four times more money can be obtained for saw timber than pulpwood.

General practices recommended by foresters for cutting pulpwood or marking trees to be cut are: cut worked-out naval stores pine, crooked or poorly formed trees in dense stands; cut heavy-crowned "wolf" trees that overtop young growth; and cut diseased, overmature, and fire scarred trees.

Trees that should be left include "round" longleaf or slash pine, the straightest and best

formed trees, and trees with good thrifty crowns. Except in crowded stands, trees which are under nine inches in diameter at breast height should be left to continue growth.

When pulpwood stumpage is only 50 cents a cord and saw-timber brings $3 per thousand board feet, a 12-inch tree is worth more than twice as much for saw-timber as it is for pulp wood. But if pulpwood stumpage is a dollar a cord, trees up to 10 inches in diameter will bring more money for pulpwood than they will for saw-timber stumpage at $3 per thousand board feet. Of course if saw-timber stumpage is $5 per thousand board feet, that makes a difference, too.

A farmer will make more money if he sells trees over 10 inches for sawlogs.

The best practice is to let the smaller trees grow, because a 12-inch tree is worth twice as much for saw-timber as a 10-inch tree.

I asked about turpentining longleaf and slash pines.

"Good business," said the Forest Service. "A 10-inch tree leased for turpentining at five cents a face per year will bring 20 cents in a 4-year period and then the wood in the tree can still be sold."

The Forest Service had a few more suggestions to pass along to timber-owners. "Selling trees by the lump sum is about the same as selling cattle without weighing them. Selling by the standard cord or by measure is the best practice. Some farmers have sold their pines at $3 an acre when there were from 10 to 20 cords of wood on an acre."

"What about selling by the 'pen?' "

"Better sell pulpwood by the standard cord instead of by the 'pen' or the 'long cord,' " the Forest Service answered. "For example, five pens of 6-inch wood make about one standard cord, but five pens of 12-inch wood make about two standard cords. The standard cord is four by four by eight feet, but when the cordwood sticks are cut longer they make a 'long' cord. If the sticks are cut 4½ feet long, the cord stack will contain 1⅛ standard cords and if the sticks are cut five feet long, the cord stack will yield 1¼ standard cords."

"Can farmers do their own timber estimating?" I asked next.

"Yes," said the Forest Service, "but they'll need some practice and a diameter tape or a pair of calipers and a cubic foot volume table."

The cubic foot volume table is something like an interest table and the foresters pointed out that to find out how many cubic feet of wood there are in a tree, it is necessary to measure the diameter and to estimate the height that can be used.

Don't Work Cotton for Nothing

Condensed from The Progressive Farmer

L. O. Brackeen

SHALLOW row cultivation for cotton after it is chopped just often enough to control weeds is recommended by agricultural engineers. If it is necessary to cultivate deep it should be done at first cultivation and not on the last. In Alabama experiments, five varying methods of cultivation produced results in acre yields of cotton as follows:

	Pounds
1. Best paying: three well-timed shallow cultivations	1,246
2. Second best: three deep and then three shallow cultivations	1,232
3. Third best: three shallow and three deep	1,193
4. Fourth best: six cultivations 4 to 5 inches deep	1,181
5. Poorest: using turnplow and big shovel	1,139

The deep cultivation caused the crop to suffer for moisture during the early season and to shed some of its leaves and fruit. Deep cultivation has its advantages in controlling nutgrass, Johnson grass, and bindweeds.

Too many cultivations are not desirable or necessary. On one of the test fields average yields over a five-year period were as follows:

	Pounds
Three shallow row cultivations	1,246
Six cultivations	1,224
Twelve cultivations	1,226

What Equipment to Use

Cultivators equipped with spring-tooth gang equipment give good results when crops are small and land not heavily infested with weeds. When crops are larger and are foul with nutgrass, cockleburs, and other large weeds it is necessary to use sweeps overlapping several inches to keep them from dodging around the grass and weeds.

For cultivating crops the pivot axle pipe gang cultivators are better adapted than channel beams and rigid axles because the plows are more easily turned to work on the sides of beds or water furrows, are more easily steered on sloping land, are stronger and seldom bend, are more easily adjusted, permit plowing closer to the crops, and operate better on curved rows.

In barring cotton for chopping and in cultivating all crops later in the season it is most important that farmers use at least one-row two-horse cultivators so that one

Reprinted by permission from The Progressive Farmer, Birmingham, Ala., June, 1937

man and two mules can do as much as two men and two mules. Experiments show that a farmer can cultivate from two to six times as much land with a one-row two-horse cultivator as he can with a single stock plow.

How Much It Saves

One man with a one-row two-horse cultivator can cover six to eight acres per day of three- to four-foot rows compared with only three to four acres making two trips per row, 1½ to two acres making four trips, and ¾ to one acre making six trips per row. Figured at $1 a day for the man and $1 a day for each horse or mule, the labor cost amounts to 37½ to 50 cents per acre with two-horse cultivator compared with 50 to 67 cents per acre with two trips per row, $1 to $1.33 with four trips, and $2 to $2.66 with six trips.

It is realized that most farmers cannot change completely from one-horse equipment in one year but they can make a start and work to that end during the next few years. That farmers are planning to use more and better farm equipment is illustrated by increased purchases this year, say engineers in advising farmers buying implements to get the very best possible. This is most important because of advancing prices of steel products.

PRIZE ESSAY AWARDS

GROUP A.

First Prize:

Vern A. Molstad

University of Minnesota

Honorable Mention:

R. F. Hutcheson

Virginia Polytechnic Institute

Honorable Mention:

Hjalmar Hulin

University of Minnesota

GROUP B.

First Prize:

Dean Parish

Manteca Union High School

Manteca, California

Honorable Mention:

Donald Woodward

Monroe Twp. School

West Liberty, Ohio

Honorable Mention:

Elmer Kolner

Brier Hill High School

Brier Hill, New York

NO ONE CAN DO YOUR READING FOR YOU

You can hire a man to plough your fields.

You can delegate much of your farm work to others.

But you have got to do your own reading.

Many an interesting article and many a helpful report which touch vitally upon the problems within your fences appear in farm magazines and bulletins which you never see. The Editors of Farmers Digest see and read them.

During the past year the Farmers Digest has sent to its subscribers 322 articles covering all phases of agriculture, selected from more than 200 farm publications.

If you have found the Farmers Digest to be valuable, we will appreciate it if you will mention it to your friends, for a word of personal recommendation carries much weight. In helping to make the Digest more widely known you will be increasing its usefulness, and your friends will be grateful to learn of this new and excellent source of information on farm problems.

The Farmers Digest is an ideal gift for the farmer, who is busy from sunup to sundown and has little time to read, and for the business man whose farm is a keen source of interest and pleasure.

We will be glad to send sample copies to anyone whom you may care to suggest.

Name_____

Address_____

Name_____

Address_____

Name of Subscriber_____

The Johnson Press, Ambler, Pa.